APPENDIX C

Development of Risk-Based Screening Levels

DEVELOPMENT OF RISK-BASED SCREENING LEVELS

Former Pechiney Cast Plate, Inc. Facility

3200 Fruitland Avenue

Vernon, California

Prepared for:

Pechiney Cast Plate, Inc.

Prepared by:

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(949) 642-0245

August 10, 2009

Project No. 10627.003

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DEVELOPMENT OF RISK-BASED SCREENING LEVELS
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3200 Fruitland Avenue
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1.0 INTRODUCTION

Risk-based screening criteria were used to evaluate potential human health risks associated with chemical exposure. Risk-based screening levels (RBSLs) were developed using the methodology presented by the California Environmental Protection Agency (Cal-EPA) Office of Environmental Health Hazard Assessment (OEHHA) for California Human Health Screening Levels (CHHSLs) (OEHHA, 2005), the Johnson and Ettinger (1991) model (Johnson and Ettinger, 1991), exposure parameters recommended by DTSC (DTSC; 2005), and recent guidance on lead and total petroleum hydrocarbons (TPH) (OEHHA, 2009; DTSC, 2009).

A site conceptual model describing the exposure assessment for the Former Pechiney Cast Plate, Inc. Facility (the Site) is presented in the Feasibility Study (FS). The receptors identified included a commercial/industrial worker (indoor and outdoor) and a construction worker (outdoor). This appendix presents the toxicity assessment, the development of RBSLs for each receptor for each medium of concern (i.e., soil, soil vapor, and groundwater; as appropriate), and an uncertainty analysis. RBSLs calculated for PCBs in soil are applicable to concrete.

2.0 TOXICITY ASSESSMENT

The toxicity criteria for cancer risks and noncancer adverse health effects used in deriving the RBSLs are presented in Table C-1 with the exception of TPH mixtures, which are addressed in Section 2.1. The hierarchy of references used for selecting these toxicity criteria is as follows:

1. OEHHA Toxicity Criteria Database, 2010 (OEHHA, 2010) or OEHHA Chronic Reference Exposure Levels, 2008 (OEHHA, 2008);

2. United States Environmental Protection Agency (U.S. EPA) Integrated Risk Information System (IRIS) on-line database, 2010a; and

3. Other U.S. EPA or U.S. Department of Health and Human Services toxicity criteria, as recommended or provided for specific chemicals in U.S. EPA, 2010b, Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites, April, or U.S. EPA, 2004, Region IX Preliminary Remediation Goals (PRGs). The other U.S. sources include Provisional Peer-Reviewed Toxicity Values (PPRTVs), values from the Agency for Toxic Substances & Disease Registry (ATSDR), values from the

National Center for Environmental Assessment (NCEA), and values from U.S. EPA Health Effects Assessment Summary Tables (HEAST).

In the event that an inhalation reference dose or slope factor was not available, route extrapolation from oral exposure was used in the calculations, unless clear toxicological evidence indicates this extrapolation is inappropriate for a specific chemical. Toxicity criteria for dermal exposure were derived using the oral reference dose (RfD) or cancer slope factor (CSF) without adjustment for reduced gastrointestinal absorption efficiency, consistent with the approach used to derive most CHHSLs (OEHHA, 2005). Surrogate toxicity criteria were used when no other criteria were available for a specific chemical. Specific surrogates were chosen based on similarities in chemical structure and expected toxicity. Surrogates used in this assessment are presented in Table C-1.

2.1 TOTAL PETROLEUM HYDROCARBONS

Various mixtures of TPH have been reported in shallow soil (surface to a depth of 15 feet below ground surface [bgs]) at the Site including: TPH as gasoline; TPH as diesel; TPH as motor oil; TPH as Stoddard solvent; total extractable petroleum hydrocarbons (TEPH); total recoverable petroleum hydrocarbons (TRPH); undifferentiated TPH; and TPH as specific hydrocarbon ranges c6-c10, c10-c20, c10-c28, and c21-c28. TPH as Stoddard solvent has also been reported in shallow soil vapor (5 and 15 feet bgs) and groundwater (at 150 feet bgs). However, toxicity criteria for use with these TPH mixtures are not available from the DTSC, OEHHA, or U.S. EPA. DTSC recommends using toxicity criteria specific to the following six groups of aliphatic and aromatic hydrocarbons to evaluate the potential risks from TPH exposure (DTSC, 2009):

- c5-c8 aliphatics
- c6-c8 aromatics
- c9-c18 aliphatics
- c9-c16 aromatics
- c19-c32 aliphatics
- c17-c32 aromatics

As described herein, toxicity criteria were developed for the TPH mixtures detected at the Site by 1) determining the aliphatic and aromatic hydrocarbon ranges typically associated with each mixture, 2) using this information to calculate weighted criteria from the aforementioned groups, and 3) summing these weighted criteria into a single criterion for each mixture (apportion method). For comparative purposes, "worst case" toxicity criteria were also developed by assuming each TPH mixture is composed of 50% aliphatic and 50% aromatic hydrocarbons (DTSC, 2009), and using the most health-protective toxicity criteria of the DTSC hydrocarbon groups associated with each mixture (worst case method). Toxicity criteria were not derived for TRPH and undifferentiated TPH as the specific hydrocarbon ranges associated with these non-discrete TPH mixtures are not understood. In most cases, other TPH analytical data that could be quantitatively evaluated were available for soil samples analyzed for TRPH and undifferentiated TPH.

2.1.1 Development of Toxicity Criteria for TPH by the Apportion Method

The process followed to develop toxicity criteria for TPH mixtures using weighting or apportioning for the specific DTSC hydrocarbon groups involved the steps described below.

1. *Estimate percentages of the DTSC hydrocarbon groups occurring in each mixture.* To estimate these percentages, the carbon chains and aliphatic/aromatic composition of each TPH mixture was first determined from ATSDR (ATSDR, 1999), California Regional Water Quality Control Board, San Francisco Bay Region (SFRWQCB, 2008), Curtis and Thompkins (2009), and/or U.S. EPA (U.S. EPA, 1996a). The percentages of the DTSC hydrocarbon groups occurring in each mixture was then estimated using the following equation (Equation 1):

$$P_x = \frac{HC_x}{HC} \times Ax \qquad (1)$$

Where:

Where:	P_x	=	percentage of DTSC hydrocarbon group (x) occurring in TPH mixture
	HC_x	=	number of carbon chain groups from DTSC hydrocarbon group occurring in TPH mixture (e.g., C5 to C8 would be 4)
	HC	=	total number of carbon chain groups in TPH mixture (e.g., C5 to C12 would be 8)
	A_x	=	aliphatic (or aromatic) percentage in TPH mixture

The carbon chains and aliphatic/aromatic percentages assigned to each TPH mixture, and the resulting calculated percentages of DTSC hydrocarbon groups occurring in each mixture, are presented in Table C-2.

2. *Normalize the percentages of DTSC hydrocarbon groups as needed.* Because DTSC recommends that individual chemicals of potential concern (COPCs) (e.g., benzene, toluene, ethylbenzene, and xylenes [BTEX]) be used to evaluate c6-c8 aromatics, contributions from this hydrocarbon group were excluded from TPH toxicity criteria development. Such COPCs have been analyzed for at the Site and would be evaluated separately with RBSLs for the individual COPCs. As a result, for the TPH mixtures consisting of some fraction of c6-c8 aromatics (TPH as gasoline, TPH as Stoddard solvent, and c6-c10 hydrocarbons), the contributions of the remaining hydrocarbon groups occurring in those mixtures (c5-c8 aliphatics, c9-c18 aliphatics, and c9-c16 aromatics) would not add up to 100% (Table C-2). To address this issue, the percentages of these groups were normalized. Similarly,

data normalization was also required for the hydrocarbon groups occurring in TPH as motor oil and TEPH. The calculated percentages of these groups did not add up to 100 percent because both mixtures contain c33+ hydrocarbons for which no toxicity criteria have been assigned. Calculated percentages were normalized in these cases using the following equation (Equation 2):

$$NP_x = \frac{P_x}{\sum P_x} \qquad (2)$$

Where: *NP_x* = normalized percentage of DTSC hydrocarbon group occurring in TPH mixture

ΣP_x = percentage sum of all DTSC hydrocarbon groups occurring in TPH mixture

All other terms previously defined.

Normalized percentages for the DTSC hydrocarbon groups occurring in each mixture are presented in Table C-2. Prior to estimating the inhalation RfDs and reference concentrations (RfC) for TPH as diesel, TEPH, c10-c20 hydrocarbons and c10-c28 hydrocarbons, the normalized percentages estimated for the DTSC hydrocarbon groups occurring in these mixtures were re-calculated to account for the low volatility and/or lack of inhalation toxicity criteria of the c19-c32 aliphatics and c17-c32 aromatics. The normalized percentages were re-calculated excluding these two groups.

3. *Calculation of toxicity criteria for each TPH mixture.* In the final step, the toxicity criteria were estimated by summing the DTSC hydrocarbon group criteria, weighted by the percentages estimated in the previous two steps (Equation 3):

$$RfD = \sum (NP_x \times RfD_x) \qquad (3)$$

Where: *RfD* = RfD (or reference concentration [RfC]) for TPH mixture (mg/kg-day) (or µg/m^3 for RfC)

RfD_x = RfD (or RfC) for DTSC hydrocarbon group (mg/kg-day or µg/m^3)

All other terms previously defined.

The RfDs and RfCs estimated for each TPH mixture by the apportion method are presented in Table C-2 and listed in Table C-1 as well.

2.1.2 Development of "Worst Case" Toxicity Criteria for TPH

For comparative purposes, a set of worst case criteria were also estimated for the mixtures of TPH detected at the Site, in soil, soil vapor and groundwater samples, by assuming each mixture consisted of 50% aliphatic and 50% aromatic hydrocarbons (DTSC, 2009) and using the most health-protective toxicity criteria for the hydrocarbon groups associated with each mixture. This assumption is conservative, given that the industry-grade composition of each mixture, as suggested by ATSDR (ATSDR, 1999), consists of approximately 65-80% aliphatic hydrocarbons (which are less toxic than aromatic hydrocarbons). Furthermore, once introduced into the environment, the effects of weathering contribute to a reduction in concentration of the lighter, more toxic hydrocarbons of each aliphatic/aromatic fraction.

The worst case toxicity criteria for TPH were calculated as follows (Equation 4):

$$RfD = (0.5 \times RfD_{al}) + (0.5 \times RfD_{ar}) \tag{4}$$

Where:

RfD = RfD (or RfC) for TPH mixture (mg/kg-day or μg/m^3)

RfD_{al} = Most health-protective RfD (or RfC) of the DTSC aliphatic hydrocarbon group within the TPH mixture (mg/kg-day or μg/m^3)

RfD_{ar} = Most health-protective RfD (or RfC) of the DTSC aromatic hydrocarbon group within the TPH mixture (mg/kg-day or μg/m^3)

The worst case RfDs and RfCs estimated for each TPH mixture are presented in Table C-3 and listed in Table C-1 as well.

3.0 RISK-BASED SCREENING LEVELS FOR SOIL

Future exposure for the outdoor commercial/industrial worker and the construction worker was assumed to be complete for chemicals in soil via incidental ingestion, dermal contact, and inhalation of airborne particulates or volatile organic compounds[1] (VOCs) in ambient air. Future exposure for the indoor commercial/industrial worker was assumed to be complete for VOCs moving from subsurface soil into indoor air. However, soil vapor is considered a more appropriate medium than soil for assessing potential vapor exposure and shallow soil vapor data (collected at 5 or 15 feet bgs) were used to evaluate potential vapor movement from the vadose zone into indoor and ambient air and inhalation exposure.

RBSLs were developed for non-volatile chemicals in soil to be protective of outdoor commercial/industrial worker exposure to soil via incidental ingestion, dermal contact, and inhalation of airborne particulates. Additional RBSLs were developed for construction workers for these chemicals following the same methodology but using construction worker exposure

[1] Chemicals are identified as VOCs if the molecular weight is less than 200 grams per mole (g/mole) and the Henry's Law Constant is greater than 1x10^{-5} atmospheres–cubic meter per mole (atm-m^3/mole).

parameters. Soil vapor data were used in place of soil data to evaluate potential vapor movement from the vadose zone into indoor and ambient air. RBSLs were developed for outdoor commercial/industrial workers and construction workers for the VOCs detected in soil to account for potential exposure via soil incidental ingestion and dermal contact. Lead was evaluated separately based on the unique health effects associated with this chemical.

3.1 RISK-BASED SCREENING LEVELS FOR SOIL (NON-LEAD EXPOSURES)

The equations used to develop the RBSLs for soil for both outdoor commercial/industrial workers and construction workers are presented below. RBSLs were developed to screen for both cancer risks (Equation 5) and noncancer adverse health effects (Equation 6). These equations consider exposure via incidental ingestion, dermal exposure, and inhalation of particulates (using a particulate emission factor [PEF]). For VOCs, the inhalation pathway component (third component of denominator in Equations 5 and 6) did not apply in the RBSL calculations.

$$RBSL_{soil-risk} = \frac{TR \times BW \times AT_{ca}}{ED \times EF \times \left[\left(\frac{IR_s \times CSF_o}{CF_{kg-mg}}\right) + \left(\frac{SAs \times SAF \times ABS \times CSF_o}{CF_{kg-mg}}\right) + \left(\frac{IHR_a \times CSF_i}{PEF}\right)\right]} \quad (5)$$

Where:

$RBSL_{soil-risk}$ = risk-based soil screening level for cancer risk (mg/kg)
TR = target cancer risk, 1×10^{-6} (unitless)
BW = body weight (kg)
AT_{ca} = averaging time - cancer (days)
ED = exposure duration (yr)
EF = exposure frequency (days/yr)
IR_s = ingestion rate of soil (mg/day)
CSF_o = oral cancer slope factor $[(mg/kg\text{-}day)^{-1}]$
CF_{kg-mg} = conversion factor from kilograms to milligrams
SAs = exposed skin surface area (cm^2)
SAF = soil-to-skin adherence factor (mg/cm^2)
ABS = dermal absorption factor (unitless)
IHR_a = inhalation rate (m^3/day)
CSF_i = inhalation cancer slope factor $[(mg/kg\text{-}day)^{-1}]$
PEF = particulate emission factor (m^3 of air/kg of soil)

$$RBSL_{soil-haz} = \frac{THQ \times BW \times AT_{nc}}{ED \times EF \times \left[\left(\frac{1}{RfD_o} \times \frac{IR_s}{CF_{kg-mg}}\right) + \left(\frac{1}{RfD_o} \times \frac{SAs \times SAF \times ABS}{CF_{kg-mg}}\right) + \left(\frac{1}{RfD_i} \times \frac{IHR_a}{PEF}\right)\right]} \quad (6)$$

Where:

$RBSL_{soil-haz}$ = risk-based soil screening level for noncancer hazard (mg/kg)
THQ = target hazard quotient, 1 (unitless)
AT_{nc} = averaging time - noncancer (days)

RfD_o = oral reference dose (mg/kg-day)
RfD_i = inhalation reference dose (mg/kg-day)
All other terms previously defined

The toxicity criteria for cancer risks and noncancer adverse health effects used in deriving the RBSLs are presented in Table C-1. Chemical-specific dermal absorption factors used in deriving the RBSLs are presented in Table C-4. Values for exposure parameters used in the RBSL calculations are listed in Tables C-5 and C-6 for outdoor commercial/industrial workers and construction workers, respectively, as obtained from DTSC (DTSC, 2005).

The RBSLs developed to screen the chemical concentrations in soil at the Site and estimate potential outdoor commercial/industrial worker cancer risks and noncancer hazards from exposure to these concentrations are presented in Table C-7. The RBSLs developed to screen the chemical concentrations in soil at the Site and estimate potential construction worker cancer risks and noncancer hazards from exposure to these concentrations are presented in Table C-8.

3.2 RISK-BASED SCREENING LEVELS FOR EXPOSURE TO LEAD IN SOIL

Although a CSF has been published by OEHHA for lead (OEHHA, 2010), noncarcinogenic health effects, particularly for children, occur at much lower concentrations than carcinogenic effects. Separate mathematical models, such as the U.S. EPA's Adult Lead Model (ALM) (U.S. EPA, 2005) and the LeadSpread model developed by the DTSC (DTSC, 1999), have been developed to evaluate these potential health concerns by estimating blood-lead levels resulting from contact with lead in various media (e.g., soil, air, food). The blood-lead level is of interest because most adverse human health effects are correlated in terms of blood-lead levels (e.g., a blood-lead level of "x" is associated with an increased incidence of adverse health effects). In contrast, risks and adverse health effects for other chemicals are correlated simply in terms of chemical intake.

The U.S. EPA's ALM and DTSC's LeadSpread model were used to develop health-based screening levels for outdoor commercial/industrial worker and construction worker exposure to total lead in soil that are protective of benchmark blood-lead levels established by the DTSC (DTSC, 1999) and OEHHA (OEHHA, 2009). For commercial/industrial workers, the health-based screening level was based on a 90th percentile estimate of a 1 microgram per deciliter (µg/dL) incremental change in the blood-lead level of the fetus of an adult worker (OEHHA, 2009). For construction workers, the health-based screening level was based on a 99th percentile 10 µg/dL blood-lead level of concern (DTSC, 1999). Leadspread was used assuming construction work would not be performed by childbearing adults. Using the ALM, the health-based screening level for commercial/industrial workers was calculated using U.S.

EPA-recommended exposure parameters, with adjustments to the blood-lead geometric standard deviation, baseline blood-lead level, and exposure frequency of adult workers to be consistent with OEHHA recommendations (OEHHA, 2009). Using LeadSpread, the health-based screening level for construction workers was calculated using default background concentrations of lead in other environmental media (e.g., air, food, water) and default exposure parameters recommended by DTSC for use with LeadSpread, with a few exceptions. Values used in the derivation of the other RBSLs were used in place of the default LeadSpread values for exposed skin surface area and soil-to-skin adherence factor; the default LeadSpread values for these parameters are intended for commercial/industrial workers and adult residents, respectively. Finally, a soil ingestion rate equivalent to 50 percent of the ingestion rate used in the derivation of the other RBSLs was used for construction workers. This adjustment is consistent with recommended soil ingestion rates by DTSC for use with LeadSpread for other receptors (i.e., residents and workers). Attachment B-1 presents the ALM calculations and Attachment B-2 presents the LeadSpread calculations used in the derivation of the health-based screening levels for outdoor commercial/industrial workers and construction workers, respectively. The resulting health-based screening levels are summarized in Table C-9.

4.0 RISK-BASED SCREENING LEVELS FOR SOIL VAPOR

As described above, future exposure for the indoor commercial/industrial worker was assumed to be complete for chemicals moving from subsurface vadose zone soil into indoor air. Similarly, for the outdoor commercial/industrial worker and construction worker assumed to spend 100 percent of their time outdoors, future exposure was considered complete for chemicals moving from subsurface vadose zone soil into ambient air. RBSLs were developed for soil vapor concentrations to evaluate vapor movement from the vadose zone into indoor or ambient air.

4.1 RISK-BASED SCREENING LEVELS FOR MOVEMENT OF VOCS TO INDOOR AIR

This section presents the derivation of RBSLs for movement of VOCs in shallow soil vapor to indoor air for indoor commercial/industrial workers. RBSLs were not derived for construction workers as these receptors are not considered to spend sufficient time indoors to warrant evaluation via this exposure pathway. The soil vapor RBSLs developed for indoor air exposures were based on the methodology for soil vapor CHHSLs for current, common slab on grade building construction practices in California, in which a building foundation is separated from underlying soil by a layer of compacted, fine-grained cohesive soil and a layer of sub-slab gravel (OEHHA, 2005). Transport of chemical vapors from shallow soil vapor into indoor air is predicted by the Johnson and Ettinger (1991) model. The process followed to develop these RBSLs is based on the process presented in Appendix B of the OEHHA guidance (OEHHA, 2005) and involves three consecutive steps:

1. *Calculation of target indoor air concentrations.* The equations used to develop the target indoor air concentrations for indoor commercial/industrial workers are presented below, based on the equations presented in Appendix B of OEHHA (2005), but accounting for the use of DTSC-recommended inhalation rates (DTSC, 2005). Target indoor air concentrations were developed for both cancer risks (Equation 7) and noncancer adverse health effects (Equation 8):

$$C_{ia-risk} = \frac{TR \times BW \times AT_{ca} \times CF_{mg-ug}}{IHR_a \times EF \times ED \times CSF_i} \quad (7)$$

Where: $C_{ia-risk}$ = target indoor air concentration for cancer risks (µg/m^3)
CF_{mg-ug} = conversion factor from milligrams to micrograms
All other terms previously defined.

$$C_{ia-haz} = \frac{THQ \times BW \times AT_{nc} \times CF_{mg-ug}}{IHR_a \times EF \times ED \times 1/RfD_i} \quad (8)$$

Where: C_{ia-haz} = target indoor air concentration for noncancer hazard (µg/m3)
All other terms previously defined.

Values of exposure parameters used in the target indoor air concentration calculations are listed in Table C-10, as obtained from DTSC (2005). The toxicity criteria for cancer risks and noncancer adverse health effects used in deriving the target indoor air concentrations are presented in Table C-1.

2. *Use of the Johnson and Ettinger (1991) model to calculate chemical-specific, soil vapor-to-indoor air attenuation factors.* The attenuation factors provided by the Johnson and Ettinger (1991) model relate vapor concentrations in indoor air to vapor concentrations in the subsurface by accounting for the one-dimensional convective and diffusive mechanisms of vapor transport from the subsurface into indoor air. Consistent with OEHHA (2005), the advanced Johnson and Ettinger model spreadsheets for subsurface vapor intrusion from soil parameterized by U.S. EPA were used to calculate the attenuation (Attachment C-1). Inputs to the advanced model spreadsheets include chemical properties, and unsaturated zone soil properties for sand from OEHHA, 2005; conservative assumptions regarding other parameters (i.e., structural properties of the building) were based on default values in the model (OEHHA, 2005).

3. *Calculation of the soil vapor RBSLs.* The soil vapor RBSLs were estimated from the calculated target indoor air concentrations and attenuation factors using the following equation:

$$RBSL_{soil\ vapor-ia} = \frac{C_{ia}}{\alpha \times CF_{m3-L}} \quad (9)$$

Where: $RBSL_{soil\ vapor-ia}$ = risk-based screening level for soil vapor, indoor air (µg/L)
C_{ia} = target indoor air concentration (µg/m^3)
α = chemical-specific attenuation factor (unitless)
CF_{m3-L} = conversion factor from cubic meters to liters

The target commercial/industrial worker indoor air concentrations, attenuation factors, and soil vapor RBSLs estimated for the chemicals detected in soil vapor at the Site are presented in Table C-11.

4.2 Risk-Based Screening Levels for Soil Vapor for Movement of VOCs to Ambient Air

RBSLs were developed for the chemical concentrations in soil vapor to be protective of potential commercial/industrial worker or construction worker exposure to the concentrations of these chemicals that may move into ambient air. The process followed to develop these RBSLs is comparable to the one outlined above for developing soil vapor RBSLs for indoor air exposure, but involves the use of different models to predict vapor flux and dispersion of chemicals from subsurface soil vapor to ambient air:

1. *Calculation of target ambient air concentrations for both cancer risks and noncancer adverse health effects.* The equations used to develop the target ambient air concentrations for outdoor commercial/industrial workers and construction workers are equivalent to the equations used to develop the target indoor air concentrations (Equations 7 and 8 above). Values of exposure parameters used in the target ambient air concentration calculations are listed in Tables C-5 and C-6 for the outdoor commercial/industrial workers and construction workers, respectively. The toxicity criteria for cancer risks and noncancer adverse health effects used in deriving the target ambient air concentrations are presented in Table C-1.

2. *Use of the X/Q Model to calculate subsurface vapor flux from the target ambient air concentrations.* The X/Q dispersion model presented in "Soil Screening Guidance: Users Guide and Technical Background Document" (U.S. EPA, 1996b) allows for the prediction of ambient air concentrations of VOCs from a known or estimated subsurface vapor emission rate. The relationship established by the X/Q dispersion model of subsurface vapor flux to ambient air concentration was used to estimate the subsurface vapor emission rate associated with each target ambient air concentration:

$$E_i = \frac{C_{oa}}{X/Q} \quad (10)$$

Where:

- E_i = emission rate (µg/m^2-sec)
- C_{oa} = target ambient air concentration (µg/m^3)
- X/Q = Dispersion factor (mg/m^3 per mg/m^2-sec); calculated from the inverse dispersion factor as presented in supporting equations in Attachment A-1.

3. *Use of the VOC Emission Model to calculate soil vapor screening levels from estimated subsurface vapor flux.* After the subsurface vapor flux was estimated, the VOC Emission Model presented in "Soil Screening Guidance: Users Guide and Technical Background Document" (U.S. EPA, 1996b) was used to estimate the soil vapor RBSL for ambient air exposures. First, the total solute concentration associated with soil vapor was estimated as follows:

$$CT = \frac{E_i \times \sqrt{\pi \times Da \times T}}{2 \times Da \times CF_{m2-cm2}} \quad (11)$$

Where:

- CT = total solute concentration (µg/cm^3)
- E_i = emission rate (µg/m^2-sec)
- Da = chemical-specific effective diffusivity in soil pore space (cm^2/sec); calculated as presented in Attachment A-1, using site-specific assumptions presented in Attachment A-2 and chemical-specific parameters presented in Table C-4
- T = exposure interval (sec) (equal to exposure duration)
- CF_{m2-cm2} = conversion factor from square meters to square centimeters

The total solute concentration was then used to derive the soil vapor RBSL via the partitioning predicted by Henry's law:

$$RBSL_{soil\ vapor-oa} = \frac{CT}{[(pb \times \mathrm{Kd/H'}) + Pw / H' + Pa] \times CF_{cm3-L}} \quad (12)$$

Where:

- $RBSL_{soil\ vapor-oa}$ = risk-based screening level for soil vapor, ambient air (µg/L)
- ρ_b = soil bulk density (g/cm^3)
- Kd = soil-organic partition coefficient (cm^3/g)
- H' = Henry's Law constant (unitless)
- Pw = water-filled soil porosity (unitless)
- Pa = air-filled soil porosity (unitless)
- CF_{cm3-L} = conversion factor from cubic centimeters to liters

All other terms previously defined.

The soil vapor RBSLs developed for commercial/industrial workers and construction workers for inhalation of ambient air are presented in Tables C-12 and C-13, respectively.

4.3 Risk-Based Screening Levels for TPH as Stoddard Solvent in Soil Vapor

TPH as Stoddard solvent was detected in shallow soil vapor at the Site. To develop RBSLs protective of potential subsurface vapor movement of Stoddard solvent into indoor or ambient air, soil vapor RBSLs were developed for the volatile aliphatic and aromatic hydrocarbon groups in the mixture, and the resulting RBSLs were then weighted and summed to estimate RBSLs for Stoddard solvent. The process was similar to the apportion method used to develop toxicity criteria for Stoddard solvent as described in Section 2.1.1, but applied to the RBSLs instead of toxicity criteria. This step was necessary because the chemical properties used to estimate volatilization are based on the TPH hydrocarbon groups and cannot be simply averaged. Soil vapor RBSLs were developed for c5-c8 aliphatics, c9-c18 aliphatics, and c9-c16 aromatics, using toxicity criteria and chemical properties recommended by DTSC (DTSC, 2009). Soil vapor RBSLs were not developed for the c6-c8 aromatic fraction, consistent with previous methods (developing toxicity criteria for TPH mixtures; Section 2.1). The individual COPCs associated with this fraction (e.g., BTEX) have been analyzed for at the Site and would be evaluated separately with individual RBSLs for these COPCs.

To develop the soil vapor RBSLs for c5-c8 aliphatics, c9-c18 aliphatics, and c9-c16 aromatics, the DTSC chemical properties for these fractions were used in the advanced Johnson and Ettinger model spreadsheets to calculate soil vapor-to-indoor air attenuation factors (Attachment C-1). The chemical properties used in the calculation of RBSLs for ambient air exposures are listed in Table C-4. The DTSC toxicity criteria for these fractions are presented in Tables C-11 through C-13 with the resulting soil vapor RBSLs for indoor commercial/ industrial workers, outdoor commercial/industrial workers, and construction workers, respectively. The soil vapor RBSLs for these fractions were then weighted in the calculation of Stoddard solvent RBSLs for all three receptors using previously calculated normalized percentages. The resulting RBSLs for TPH as Stoddard solvent in soil vapor are presented in Table C-14.

Worst case RBSLs were also developed assuming Stoddard solvent is composed of 50% aliphatic and 50% aromatic hydrocarbons (DTSC, 2009) (instead of 80% aliphatics/20% aromatics identified by ATSDR [1999]), and using the most health-protective RBSLs of the volatile aliphatic and aromatic hydrocarbon groups within the mixture. For Stoddard solvent, the RBSLs developed for c9-c18 aliphatics and c9-c16 aromatics were used, with the resulting worst case RBSLs calculated as presented in Table C-14.

5.0 RISK-BASED SCREENING LEVELS FOR GROUNDWATER

RBSLs were developed for the VOCs detected in groundwater to be protective of potential inhalation exposures to concentrations that may move into indoor air. The RBSLs were developed independent of the RBSLs developed for soil vapor described in Section 4.0 above to differentiate vadose zone from groundwater contamination. RBSLs were only developed for potential vapor movement into indoor air to simplify the analysis since these concentrations would also be protective of receptors exposed to ambient air (i.e., outdoor commercial/ industrial workers and construction workers).

RBSLs were developed using the Johnson and Ettinger (1991) model for subsurface vapor intrusion from groundwater. Specifically, the "Calculate Risk-based Groundwater Concentration" function in the advanced Johnson and Ettinger model spreadsheets parameterized by U.S. EPA were used to calculate the RBSLs. Inputs to the advanced model spreadsheets include site-specific unsaturated zone soil properties based on the logs of borings 125 and 126, which were advanced to groundwater at the Site (approximately 150 feet bgs). Because similar lithology has been encountered throughout the Site (Section 2.3.2.1 of the FS), the soil lithologic properties assigned to the Johnson and Ettinger model spreadsheets based on the lithologic profile from these two borings was considered representative of site-wide conditions. Conservative assumptions regarding other parameters (i.e., structural properties of future buildings) were based on default values in the model. All input parameters provided to the model are summarized in Attachment D-1. The model spreadsheets used to estimate the RBSLs are provided in Attachment D-2. A summary of the resulting RBSLs is provided in Table 2 of the FS.

5.1 RISK-BASED SCREENING LEVELS FOR TPH AS GASOLINE IN GROUNDWATER

With TPH as gasoline detected in groundwater at the Site, an RBSL protective of potential vapor intrusion from groundwater was developed following the same process described above for TPH as Stoddard solvent in soil vapor (Section 4.3). Groundwater RBSLs were developed for the volatile aliphatic and aromatic hydrocarbon groups in the mixture as discussed in Section 5.0 and presented in Attachment D. The resulting RBSLs were subsequently weighted using calculated normalized percentages, and then summed. The resulting RBSL for TPH as gasoline in groundwater is presented in Table C-15.

For comparison, a worst case RBSL was also developed assuming gasoline is composed of 50% aliphatic and 50% aromatic hydrocarbons (DTSC, 2009), and using the most health-protective RBSLs developed for the volatile fractions in the mixture. The RBSLs developed for c9-c18 aliphatics and c9-c16 aromatics were used, with the resulting worst case RBSL calculated as presented in Table C-15.

6.0 UNCERTAINTY ANALYSIS

Uncertainties are inherent in the development of RBSLs, and the use of these values to derive estimates of potential cancer risk and noncancer health hazards. In the development of screening levels, uncertainty arises from a lack of knowledge of toxicity and dose-response of the chemicals, and the extent to which an individual will be exposed to those chemicals (U.S. EPA, 1989). Assumptions are made based on information presented in the scientific literature or professional judgment. While some assumptions have significant scientific basis, others have less scientific basis. The assumptions that introduce the greatest amount of uncertainty in the development of RBSL are discussed below, consistent with U.S. EPA requirements (U.S. EPA, 1989). Uncertainties associated with other aspects of the risk assessment process, such as site characterization, data evaluation, and the use of screening levels in risk characterization, are presented in the report.

6.1 ENVIRONMENTAL FATE AND TRANSPORT

Fate and transport models were used in the development of RBSLs to predict the movement of vapors into indoor and ambient air. While some site-specific conditions were incorporated into the analysis, the models are screening-level models, which typically are conservative and predict concentrations that overestimate risk. For example, biodegradation of petroleum hydrocarbon constituents in the vadose zone is not considered by the model. In addition, conservative assumptions about future building design have been incorporated into the indoor air model (e.g., slab-on-grade foundations). The development of RBSLs is therefore dependent on future building conditions being consistent with those included in the model.

6.2 EXPOSURE ASSUMPTIONS AND PARAMETERS

The exposure parameters used to derive the RBSLs are based on reasonable maximum exposure (RME), which is defined by U.S. EPA as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site (U.S. EPA, 1989). The exposure parameters associated with a RME scenario are therefore highly conservative. For example, under RME conditions, it is assumed that a commercial/industrial worker is present on-site for 250 days per year for 25 years. The use of such upper-bound estimates in the development of RBSL most likely results in overly protective values.

6.3 TOXICITY CRITERIA

One of the largest sources of uncertainty in any risk assessment is associated with the scientific community's limited understanding of the toxicity of most chemicals in humans following exposure to the low concentrations generally encountered in the environment. The majority of available toxicity data are from animal studies, which are then extrapolated using mathematical models or multiple uncertainty factors to generate toxicity criteria used to predict what might occur in humans. Sources of conservatism in the toxicity criteria used in this evaluation include:

- the use of conservative methods and assumptions to extrapolate from high dose animal studies to predict the possible response in humans at exposure levels far below those administered to animals;
- the assumption that chemicals considered to be carcinogens do not have thresholds (i.e., for all doses greater than zero, some risk is assumed to be present); and
- the fact that epidemiological studies (i.e., human exposure studies) are limited and are not generally considered in a quantitative manner in deriving toxicity values.

The toxicity criteria used in the development of RBSLs were developed using different methods. The noncarcinogenic criteria (i.e., oral and inhalation RfDs) incorporate multiple safety factors to account for limitations in the quality or quantity of available data (e.g., animal data in lieu of human data). These safety factors are applied without regard to available data on the true likelihood of a variation in human response. Therefore, RfDs may be hundreds of times smaller than doses that would actually cause adverse health effects. This purposeful bias in the development of RfDs overestimates the actual potential for noncarcinogenic health risks for these chemicals.

The carcinogenic toxicity criteria (i.e., oral and inhalation CSFs) also are developed using techniques that purposefully bias the criteria toward health conservatism. For example, most CSFs are based on the premise that cancer data from high dose animal studies will predict cancer response in humans at dose levels thousands of times lower. The process also assumes that the carcinogenicity of a chemical in an animal model is representative of the response in humans. Finally, the statistical techniques used by regulatory agencies to extrapolate data from animals to human exposures generally assume that the dose-response curve is linear and that the 95% upper confidence limit of the mean of the slope is representative of the chemical's carcinogenic potency. In aggregate, these assumptions overestimate the actual risk estimates such that they are unlikely to be higher, but could be considerably lower and, in fact, could be non-existent.

A second uncertainty associated with toxicity criteria is the unavailability of RfDs or CSFs for all chemicals at the Site. RBSLs can only be derived for those chemicals for which the relevant toxicity criteria are available. In the absence of data for the inhalation route of exposure, the CSF or RfD for the oral route for these chemicals was used in the evaluation. As a result, the RBSLs for these chemicals may be over- or underestimated. Further, the use of oral toxicity values to assess the dermal pathway introduces additional uncertainty into the results; RBSLs may be overestimated or underestimated using this approach as well. Lastly, in just a few cases, surrogate chemicals were used to represent the toxicity of other chemicals. While the selection and use of surrogates for toxicity criteria is not ideal, the surrogates selected for use in the HHRA were all very closely structurally related to the contaminants they were chosen to represent. A lack of a toxicity criterion would otherwise remain a data gap. The degree of uncertainty contributed by the use of surrogates in this manner is unknown but is not expected to result in significant underestimates of risk.

7.0 REFERENCES

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TABLE C-1

TOXICITY CRITERIA FOR CHEMICALS OF POTENTIAL CONCERN
Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Chemical	Surrogate	Carcinogenic Toxicity Criteria												Chronic Noncarcinogenic Toxicity Criteria										
		Oral				Dermal	Inhalation							Oral			Dermal	Inhalation						
		OEHHA CSFo[1]	U.S. EPA CSFo[2]	Other CSFo[3]	Final CSFo[4]	CSFd[5]	OEHHA URF[1]	OEHHA CSFi[6]	U.S. EPA URF[2]	U.S. EPA CSFi[6]	Other URF[3]	Other CSFi[6]	Final CSFi[4]	U.S. EPA RfDo[2]	Other RfDo[3]	Final RfDo[7]	RfDd[5]	OEHHA REL[1]	OEHHA RfDi[8]	U.S. EPA RfC[2]	U.S. EPA RfDi[8]	Other RfC[3]	Other RfDi[8]	Final RfDi[4]
		$(mg/kg\text{-}day)^{-1}$	$(mg/kg\text{-}day)^{-1}$	$(mg/kg\text{-}day)^{-1}$	$(mg/kg\text{-}day)^{-1}$	$(mg/kg\text{-}day)^{-1}$	$(\mu g/m^3)^{-1}$	$(mg/kg\text{-}day)^{-1}$	$(\mu g/m^3)^{-1}$	$(mg/kg\text{-}day)^{-1}$	$(\mu g/m^3)^{-1}$	$(mg/kg\text{-}day)^{-1}$	$(mg/kg\text{-}day)^{-1}$	(mg/kg-day)	(mg/kg-day)	(mg/kg-day)	(mg/kg-day)	$(\mu g/m^3)$	(mg/kg-day)	$(\mu g/m^3)$	(mg/kg-day)	$(\mu g/m^3)$	(mg/kg-day)	(mg/kg-day)
Polychlorinated Biphenyls (PCBs)																								
Aroclors																								
Aroclor-1016		2.00E+00	7.00E-02	NA	2.00E+00	2.00E+00	5.70E-04	2.00E+00	2.00E-05	7.00E-02	NA	NA	2.00E+00	7.00E-05	NA	7.00E-05	7.00E-05	NA	NA	NA	NA	NA	7.00E-05 r	7.00E-05
Aroclor-1232		2.00E+00	2.00E+00	NA	2.00E+00	2.00E+00	5.70E-04	2.00E+00	5.70E-04	2.00E+00	NA	NA	2.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248		2.00E+00	2.00E+00	NA	2.00E+00	2.00E+00	5.70E-04	2.00E+00	5.70E-04	2.00E+00	NA	NA	2.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1254		2.00E+00	2.00E+00	NA	2.00E+00	2.00E+00	5.70E-04	2.00E+00	5.70E-04	2.00E+00	NA	NA	2.00E+00	2.00E-05	NA	2.00E-05	2.00E-05	NA	NA	NA	NA	NA	2.00E-05 r	2.00E-05
Aroclor-1260		2.00E+00	2.00E+00	NA	2.00E+00	2.00E+00	5.70E-04	2.00E+00	5.70E-04	2.00E+00	NA	NA	2.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxin-like PCB Congeners																								
PCB 77		NA[9]	NA	1.30E+01 t	1.30E+01	1.30E+01	NA[9]	NA	NA	NA	3.80E-03 t	1.30E+01	1.30E+01	NA	1.00E-05 t	1.00E-05	1.00E-05	NA	NA	NA	NA	4.00E-01 t	1.14E-04	1.14E-04
PCB 81		NA[9]	NA	3.90E+01 t	3.90E+01	3.90E+01	NA[9]	NA	NA	NA	1.14E-02 t	3.90E+01	3.90E+01	NA	3.33E-06 t	3.33E-06	3.33E-06	NA	NA	NA	NA	1.33E-01 t	3.81E-05	3.81E-05
PCB 105		NA[9]	NA	3.90E+00 t	3.90E+00	3.90E+00	NA[9]	NA	NA	NA	1.14E-03 t	3.90E+00	3.90E+00	NA	3.33E-05 t	3.33E-05	3.33E-05	NA	NA	NA	NA	1.33E+00 t	3.81E-04	3.81E-04
PCB 114		NA[9]	NA	3.90E+00 t	3.90E+00	3.90E+00	NA[9]	NA	NA	NA	1.14E-03 t	3.90E+00	3.90E+00	NA	3.33E-05 t	3.33E-05	3.33E-05	NA	NA	NA	NA	1.33E+00 t	3.81E-04	3.81E-04
PCB 118		NA[9]	NA	3.90E+00 t	3.90E+00	3.90E+00	NA[9]	NA	NA	NA	1.14E-03 t	3.90E+00	3.90E+00	NA	3.33E-05 t	3.33E-05	3.33E-05	NA	NA	NA	NA	1.33E+00 t	3.81E-04	3.81E-04
PCB 123		NA[9]	NA	3.90E+00 t	3.90E+00	3.90E+00	NA[9]	NA	NA	NA	1.14E-03 t	3.90E+00	3.90E+00	NA	3.33E-05 t	3.33E-05	3.33E-05	NA	NA	NA	NA	1.33E+00 t	3.81E-04	3.81E-04
PCB 126		NA[9]	NA	1.30E+04 t	1.30E+04	1.30E+04	NA[9]	NA	NA	NA	3.80E+00 t	1.30E+04	1.30E+04	NA	1.00E-08 t	1.00E-08	1.00E-08	NA	NA	NA	NA	4.00E-04 t	1.14E-07	1.14E-07
PCB 156, 157		NA[9]	NA	3.90E+00 t	3.90E+00	3.90E+00	NA[9]	NA	NA	NA	1.14E-03 t	3.90E+00	3.90E+00	NA	3.33E-05 t	3.33E-05	3.33E-05	NA	NA	NA	NA	1.33E+00 t	3.81E-04	3.81E-04
PCB 167		NA[9]	NA	3.90E+00 t	3.90E+00	3.90E+00	NA[9]	NA	NA	NA	1.14E-03 t	3.90E+00	3.90E+00	NA	3.33E-05 t	3.33E-05	3.33E-05	NA	NA	NA	NA	1.33E+00 t	3.81E-04	3.81E-04
PCB 169		NA[9]	NA	3.90E+03 t	3.90E+03	3.90E+03	NA[9]	NA	NA	NA	1.14E+00 t	3.90E+03	3.90E+03	NA	3.33E-08 t	3.33E-08	3.33E-08	NA	NA	NA	NA	1.33E-03 t	3.81E-07	3.81E-07
PCB 189		NA[9]	NA	3.90E+00 t	3.90E+00	3.90E+00	NA[9]	NA	NA	NA	1.14E-03 t	3.90E+00	3.90E+00	NA	3.33E-05 t	3.33E-05	3.33E-05	NA	NA	NA	NA	1.33E+00 t	3.81E-04	3.81E-04
Dioxin-like PCB Congeners (TEQ)		1.30E+05	NA	NA	1.30E+05	1.30E+05	3.80E+01	1.30E+05	NA	NA	NA	NA	1.30E+05	NA	1.00E-09 a	1.00E-09	1.00E-09	4.00E-05	1.14E-08	NA	NA	NA	NA	1.14E-08
Metals																								
Arsenic		1.50E+00	1.50E+00	NA	1.50E+00	1.50E+00	3.30E-03	1.20E+01	4.30E-03	1.51E+01	NA	NA	1.20E+01	3.00E-04	NA	3.00E-04	3.00E-04	1.50E-02	4.29E-06	NA	NA	NA	NA	4.29E-06
Barium		NA	NC	NA	NC	NC	NA	NA	NC	NC	NA	NA	NC	2.00E-01	NA	2.00E-01	2.00E-01	NA	NA	NA	NA	5.00E-01 h	1.43E-04	1.43E-04
Beryllium		NA	NA	NA	NA	NA	2.40E-03	8.40E+00	2.40E-03	8.40E+00	NA	NA	8.40E+00	2.00E-03	NA	2.00E-03	2.00E-03	7.00E-03	2.00E-06	2.00E-02	5.71E-06	NA	NA	2.00E-06
Cadmium		NA	NA	NA	NA	NA	4.20E-03	1.50E+01	1.80E-03	6.30E+00	NA	NA	1.50E+01	5.00E-04	NA	5.00E-04	5.00E-04	2.00E-02	5.71E-06	NA	NA	1.00E-02 a	2.86E-06	5.71E-06
Chromium (total)	Total Cr (inhalation slope factor) Chromium III (oral reference dose)	NA	NA	NA	NA	NA	NA	NA	1.20E-02	4.20E+01	NA	NA	4.20E+01	1.50E+00	NA	1.50E+00	1.50E+00	NA	NA	NA	NA	NA	1.50E+00 r	1.50E+00
Chromium VI		NA	NA	NA	NA	NA	1.50E-01	5.10E+02	8.40E-02	2.94E+02	NA	NA	5.10E+02	3.00E-03	NA	3.00E-03	3.00E-03	2.00E-01	5.71E-05	1.00E-01	2.86E-05	NA	NA	5.71E-05
Cobalt		NA	NA	NA	NA	NA	NA	NA	NA	NA	9.00E-03 p	3.15E+01	3.15E+01	NA	3.00E-04 p	3.00E-04	3.00E-04	NA	NA	NA	NA	6.00E-03 p	1.71E-06	1.71E-06
Copper		NA	NC	NA	NC	NC	NA	NA	NC	NC	NA	NA	NC	NA	4.00E-02 h	4.00E-02	4.00E-02	NA	NA	NA	NA	NA	3.70E-02 r	3.70E-02
Lead		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	Mercuric chloride (oral reference dose)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.00E-04	NA	3.00E-04	3.00E-04	3.00E-02	8.57E-06	NA	NA	NA	NA	8.57E-06
Molybdenum		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.00E-03	NA	5.00E-03	5.00E-03	NA	NA	NA	NA	NA	5.00E-03 r	5.00E-03
Nickel		NA	NA	NA	NA	NA	2.60E-04	9.10E-01	NA	NA	NA	NA	9.10E-01	2.00E-02	NA	2.00E-02	2.00E-02	5.00E-02	1.43E-05	NA	NA	9.00E-02 a	2.57E-05	1.43E-05
Selenium		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.00E-03	NA	5.00E-03	5.00E-03	2.00E+01	5.71E-03	NA	NA	NA	NA	5.71E-03
Silver		NA	NC	NA	NC	NC	NA	NA	NC	NC	NA	NA	NC	5.00E-03	NA	5.00E-03	5.00E-03	NA	NA	NA	NA	NA	5.00E-03 r	5.00E-03
Thallium		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.50E-05	NA	6.50E-05	6.50E-05	NA	NA	NA	NA	NA	8.00E-05 r	8.00E-05
Vanadium		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.00E-03 h	7.00E-03	7.00E-03	NA	NA	NA	NA	NA	7.00E-03 r	7.00E-03
Zinc		NA	NC	NA	NC	NC	NA	NA	NC	NC	NA	NA	NC	3.00E-01	NA	3.00E-01	3.00E-01	NA	NA	NA	NA	NA	3.00E-01 r	3.00E-01
Total Petroleum Hydrocarbons (Apportion Method)																								
TPH as gasoline		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.30E-02 calc	5.30E-02	5.30E-02	NA	NA	NA	NA	4.50E+02 calc	1.30E-01 calc	1.30E-01
TPH as diesel		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.70E-01 calc	5.70E-01	5.70E-01	NA	NA	NA	NA	1.30E+02 calc	3.60E-02 calc	3.60E-02
TPH as motor oil		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.51E+00 calc	1.51E+00	1.51E+00	NA	NA	NA	NA	NA calc	NA calc	NA
TPH as Stoddard solvent		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.90E-02 calc	6.90E-02	6.90E-02	NA	NA	NA	NA	3.80E+02 calc	1.10E-01 calc	1.10E-01
TEPH		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.90E-01 calc	8.90E-01	8.90E-01	NA	NA	NA	NA	8.70E+01 calc	2.50E-02 calc	2.50E-02
c6-c10 hydrocarbons		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.30E-02 calc	5.30E-02	5.30E-02	NA	NA	NA	NA	4.50E+02 calc	1.30E-01 calc	1.30E-01
c10-c20 hydrocarbons		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.90E-01 calc	2.90E-01	2.90E-01	NA	NA	NA	NA	1.70E+02 calc	4.90E-02 calc	4.90E-02
c10-c28 hydrocarbons		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.20E-01 calc	7.20E-01	7.20E-01	NA	NA	NA	NA	9.90E+01 calc	2.80E-02 calc	2.80E-02
c21-c28 hydrocarbons		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.31E+00 calc	1.31E+00	1.31E+00	NA	NA	NA	NA	NA calc	NA calc	NA
Total Petroleum Hydrocarbons (Worst Case)																								
TPH as gasoline		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.20E-02 calc	2.20E-02	2.20E-02	NA	NA	NA	NA	1.80E+02 calc	5.00E-02 calc	5.00E-02
TPH as diesel		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.20E-02 calc	5.20E-02	5.20E-02	NA	NA	NA	NA	1.80E+02 calc	5.00E-02 calc	5.00E-02

TABLE C-1

TOXICITY CRITERIA FOR CHEMICALS OF POTENTIAL CONCERN
Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Carcinogenic Toxicity Criteria

Chemical	Surrogate	Oral: OEHHA CSFo[1] (mg/kg-day)$^{-1}$	Oral: U.S. EPA CSFo[2] (mg/kg-day)$^{-1}$	Oral: Other CSFo[3] (mg/kg-day)$^{-1}$	Oral: Final CSFo[4] (mg/kg-day)$^{-1}$	Dermal: CSFd[5] (mg/kg-day)$^{-1}$	Inhalation: OEHHA URF[1] (µg/m^3)$^{-1}$	Inhalation: OEHHA CSFi[6] (mg/kg-day)$^{-1}$	Inhalation: U.S. EPA URF[2] (µg/m^3)$^{-1}$	Inhalation: U.S. EPA CSFi[6] (mg/kg-day)$^{-1}$	Inhalation: Other URF[3] (µg/m^3)$^{-1}$	Inhalation: Other CSFi[6] (mg/kg-day)$^{-1}$	Inhalation: Final CSFi[4] (mg/kg-day)$^{-1}$
TPH as motor oil		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH as Stoddard solvent		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TEPH		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c6-c10 hydrocarbons		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c10-c20 hydrocarbons		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c10-c28 hydrocarbons		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c21-c28 hydrocarbons		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds (VOCs)													
Acetone		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene		1.00E-01	5.50E-02	NA	1.00E-01	1.00E-01	2.90E-05	1.00E-01	7.80E-06	2.73E-02	NA	NA	1.00E-01
2-Butanone (MEK)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride		1.50E-01	1.30E-01	NA	1.50E-01	1.50E-01	4.20E-05	1.50E-01	1.50E-05	5.25E-02	NA	NA	1.50E-01
Chloroform		3.10E-02	NA	NA	3.10E-02	3.10E-02	5.30E-06	1.90E-02	2.30E-05	8.05E-02	NA	NA	1.90E-02
1,2-Dichloroethane (EDC)		4.70E-02	9.10E-02	NA	4.70E-02	4.70E-02	2.10E-05	7.20E-02	2.60E-05	9.10E-02	NA	NA	7.20E-02
1,1-Dichloroethylene		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethylene		NA	NC	NA	NC	NC	NA	NA	NC	NC	NA	NA	NC
Ethylbenzene		1.10E-02	NC	NA	1.10E-02	1.10E-02	2.50E-06	8.70E-03	NA	NA	NA	NA	8.70E-03
Isopropylbenzene		NA	NC	NA	NC	NC	NA	NA	NC	NC	NA	NA	NC
Isopropyltoluene	Isopropylbenzene	NA	NC	NA	NC	NC	NA	NA	NC	NC	NA	NA	NC
Naphthalene		NA	NA	NA	NA	NA	3.40E-05	1.20E-01	NA	NA	NA	NA	1.20E-01
n-Propylbenzene		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethylene (PCE)		5.40E-01	NA	NA	5.40E-01	5.40E-01	5.90E-06	2.10E-02	NA	NA	NA	NA	2.10E-02
Toluene		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane		NA	NC	NA	NC	NC	NA	NA	NC	NC	NA	NA	NC
Trichloroethylene (TCE)		5.90E-03	NA	NA	5.90E-03	5.90E-03	2.00E-06	7.00E-03	NA	NA	NA	NA	7.00E-03
1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene (oral reference dose)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Xylenes		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylenes	Xylenes (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	Xylenes (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Chronic Noncarcinogenic Toxicity Criteria

Chemical	Oral: U.S. EPA RfDo[2] (mg/kg-day)	Oral: Other RfDo[3] (mg/kg-day)	Oral: Final RfDo[7] (mg/kg-day)	Dermal: RfDd[5] (mg/kg-day)	Inhalation: OEHHA REL[1] (µg/m^3)	Inhalation: OEHHA RfDi[8] (mg/kg-day)	Inhalation: U.S. EPA RfC[2] (µg/m^3)	Inhalation: U.S. EPA RfDi[8] (mg/kg-day)	Inhalation: Other RfC[3] (µg/m^3)	Inhalation: Other RfDi[8] (mg/kg-day)	Inhalation: Final RfDi[4] (mg/kg-day)
TPH as motor oil	NA	1.02E+00 calc	1.02E+00	1.02E+00	NA	NA	NA	NA	NA calc	NA calc	NA
TPH as Stoddard solvent	NA	2.20E-02 calc	2.20E-02	2.20E-02	NA	NA	NA	NA	1.80E+02 calc	5.00E-02 calc	5.00E-02
TEPH	NA	5.20E-02 calc	5.20E-02	5.20E-02	NA	NA	NA	NA	1.80E+02 calc	5.00E-02 calc	5.00E-02
c6-c10 hydrocarbons	NA	2.20E-02 calc	2.20E-02	2.20E-02	NA	NA	NA	NA	1.80E+02 calc	5.00E-02 calc	5.00E-02
c10-c20 hydrocarbons	NA	5.20E-02 calc	5.20E-02	5.20E-02	NA	NA	NA	NA	1.80E+02 calc	5.00E-02 calc	5.00E-02
c10-c28 hydrocarbons	NA	5.20E-02 calc	5.20E-02	5.20E-02	NA	NA	NA	NA	1.80E+02 calc	5.00E-02 calc	5.00E-02
c21-c28 hydrocarbons	NA	1.02E+00 calc	1.02E+00	1.02E+00	NA	NA	NA	NA	1.80E+02 calc	NA calc	NA
Volatile Organic Compounds (VOCs)											
Acetone	9.00E-01	NA	9.00E-01	9.00E-01	NA	NA	NA	NA	3.10E+04 a	8.86E+00	8.86E+00
Benzene	4.00E-03	NA	4.00E-03	4.00E-03	6.00E+01	1.71E-02	3.00E+01	8.57E-03	NA	NA	1.71E-02
2-Butanone (MEK)	6.00E-01	NA	6.00E-01	6.00E-01	NA	NA	5.00E+03	1.43E+00	NA	NA	1.43E+00
n-Butylbenzene	NA	4.00E-02 n	4.00E-02	4.00E-02	NA	NA	NA	NA	NA	4.00E-02 r	4.00E-02
sec-Butylbenzene	NA	4.00E-02 n	4.00E-02	4.00E-02	NA	NA	NA	NA	NA	4.00E-02 r	4.00E-02
Carbon Tetrachloride	7.00E-04	NA	7.00E-04	7.00E-04	4.00E+01	1.14E-02	NA	NA	1.90E+02 a	5.43E-02	1.14E-02
Chloroform	1.00E-02	NA	1.00E-02	1.00E-02	3.00E+02	8.57E-02	NA	NA	9.80E+01 a	2.80E-02	8.57E-02
1,2-Dichloroethane (EDC)	NA	2.00E-02 p	2.00E-02	2.00E-02	NA	NA	NA	NA	2.40E+03 a	6.86E-01	6.86E-01
1,1-Dichloroethylene	5.00E-02	NA	5.00E-02	5.00E-02	7.00E+01	2.00E-02	2.00E+02	5.71E-02	NA	NA	2.00E-02
cis-1,2-Dichloroethylene	NA	1.00E-02 p	1.00E-02	1.00E-02	NA	NA	NA	NA	NA	1.00E-02 r	1.00E-02
Ethylbenzene	1.00E-01	NA	1.00E-01	1.00E-01	2.00E+03	5.71E-01	1.00E+03	2.86E-01	NA	NA	5.71E-01
Isopropylbenzene	1.00E-01	NA	1.00E-01	1.00E-01	NA	NA	4.00E+02	1.14E-01	NA	NA	1.14E-01
Isopropyltoluene	1.00E-01	NA	1.00E-01	1.00E-01	NA	NA	4.00E+02	1.14E-01	NA	NA	1.14E-01
Naphthalene	2.00E-02	NA	2.00E-02	2.00E-02	9.00E+00	2.57E-03	3.00E+00	8.57E-04	NA	NA	2.57E-03
n-Propylbenzene	NA	4.00E-02 n	4.00E-02	4.00E-02	NA	NA	NA	NA	NA	4.00E-02 r	4.00E-02
Tetrachloroethylene (PCE)	1.00E-02	NA	1.00E-02	1.00E-02	3.50E+01	1.00E-02	NA	NA	2.70E+02 a	7.71E-02	1.00E-02
Toluene	8.00E-02	NA	8.00E-02	8.00E-02	3.00E+02	8.57E-02	5.00E+03	1.43E+00	NA	NA	8.57E-02
1,1,1-Trichloroethane	2.00E+00	NA	2.00E+00	2.00E+00	NA	NA	5.00E+03	1.43E+00	NA	NA	1.43E+00
Trichloroethylene (TCE)	NA	3.00E-04 n	3.00E-04	3.00E-04	6.00E+02	1.71E-01	NA	NA	NA	NA	1.71E-01
1,2,4-Trimethylbenzene	NA	5.00E-02 p	5.00E-02	5.00E-02	NA	NA	NA	NA	7.00E+00 p	2.00E-03	2.00E-03
1,3,5-Trimethylbenzene	NA	5.00E-02 p	5.00E-02	5.00E-02	NA	NA	NA	NA	6.00E+00 p	1.71E-03	1.71E-03
Total Xylenes	2.00E-01	--	2.00E-01	2.00E-01	7.00E+02	2.00E-01	1.00E+02	2.86E-02	NA	NA	2.00E-01
m,p-Xylenes	2.00E-01	--	2.00E-01	2.00E-01	7.00E+02	2.00E-01	1.00E+02	2.86E-02	NA	NA	2.00E-01
o-Xylene	2.00E-01	--	2.00E-01	2.00E-01	7.00E+02	2.00E-01	1.00E+02	2.86E-02	NA	NA	2.00E-01

Notes:
1. Office of Environmental Health Hazard Assessment (OEHHA), 2010, Toxicity Criteria Database; or OEHHA, 2008, Chronic Reference Exposure Levels.
2. U.S. EPA, 2010a, Integrated Risk Information System (IRIS) database.
3. Other U.S. EPA or U.S. Department of Health and Human Services toxicity criteria, as recommended or provided for specific chemicals in U.S. EPA, 2009b, Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites, April, or U.S. EPA, 2004c, Region IX Preliminary Remediation Goals (PRGs).
Apportion Method and Worst-Case toxicity criteria for TPH mixtures calculated as described in Section 2.1 and Tables C-2 and C-3.
- a Toxicity value from ATSDR, as provided in U.S. EPA, 2010b, Regional Screening Levels
- h Toxicity value from HEAST, as provided in U.S. EPA, 2010b, Regional Screening Levels
- n Toxicity value from NCEA, as provided in U.S. EPA, 2004, Region 9 Preliminary Remediation Goals
- p PPRTV used as toxicity value, as provided in U.S. EPA, 2010b, Regional Screening Levels
- r Toxicity value derived via route-extrapolation, as recommended by DTSC (2009)
- t CSFos, URFs, RFDos, and RfCs for dioxin-like PCB congeners calculated by multiplying the corresponding criteria for dioxin TEQ by the congener-specific WHO 2005 toxic equivalency factors (TEFs) (Van den Berg et al., 2006)

4. The final criteria is selected, in order, from OEHHA, IRIS, and then other U.S. EPA toxicity criteria sources.
5. In the derivation of dermal toxicity factors, gastrointestinal absorption efficiency was assumed to be 100 percent for all chemicals.
6. CSFis calculated from URFs as follows: CSFi = (URF x 70 kg x 1000 µg/mg)/(20 m^3/day), unless provided by OEHHA Toxicity Criteria Database.
7. The final oral reference dose is selected, in order, from IRIS and then other U.S. EPA toxicity criteria sources.
8. RfDis calculated from RfCs as follows: RfDi = RfC x (0.001 mg/µg) x (20 m^3/day)/(70 kg), unless route-extrapolated from an RfDo as indicated.
9. CSFos and CSFis for dioxin-like PCB congeners are available from OEHHA's Toxicity Criteria Database, but these criteria are based on the older (since-replaced) WHO 1997 TEFs

Abbreviations:
- CSFd = dermal cancer slope factor
- CSFi = inhalation cancer slope factor
- CSFo = oral cancer slope factor
- HEAST = Health Effects Assessment Summary Tables
- mg/kg-day = milligrams per kilogram per day
- µg/m^3 = micrograms per cubic meter

TABLE C-1

TOXICITY CRITERIA FOR CHEMICALS OF POTENTIAL CONCERN

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Chemical	Surrogate	Carcinogenic Toxicity Criteria													Chronic Noncarcinogenic Toxicity Criteria											
		Oral				Dermal	Inhalation								Oral			Dermal	Inhalation							
		OEHHA CSFo[1]	U.S. EPA CSFo[2]	Other CSFo[3]	Final CSFo[4]	CSFd[5]	OEHHA URF[1]	OEHHA CSFi[6]	U.S. EPA URF[2]	U.S. EPA CSFi[6]	Other URF[3]	Other CSFi[6]	Final CSFi[4]	U.S. EPA RfDo[2]	Other RfDo[3]	Final RfDo[7]	RfDd[5]	OEHHA REL[1]	OEHHA RfDi[8]	U.S. EPA RfC[2]	U.S. EPA RfDi[8]	Other RfC[3]	Other RfDi[8]	Final RfDi[4]
		(mg/kg-day)$^{-1}$	(mg/kg-day)$^{-1}$	(mg/kg-day)$^{-1}$	(mg/kg-day)$^{-1}$	(mg/kg-day)$^{-1}$	(µg/m^3)$^{-1}$	(mg/kg-day)$^{-1}$	(µg/m^3)$^{-1}$	(mg/kg-day)$^{-1}$	(µg/m^3)$^{-1}$	(mg/kg-day)$^{-1}$	(mg/kg-day)$^{-1}$	(mg/kg-day)	(mg/kg-day)	(mg/kg-day)	(mg/kg-day)	(µg/m^3)	(mg/kg-day)	(µg/m^3)	(mg/kg-day)	(µg/m^3)	(mg/kg-day)	(mg/kg-day)

NA = not available
NC = noncarcinogenic
NCEA = National Center for Environmental Assessment
PPRTV = Provisional Peer-Reviewed Toxicity Value
RfC = reference concentration
RfDd = dermal reference dose
RfDi = inhalation reference dose
RfDo = oral reference dose
REL = reference exposure level
URF = unit risk factor
U.S. EPA = United States Environmental Protection Agency

References:

Department of Toxic Substances Control (DTSC), 2009, DTSC Recommended Methodology for Use of U.S. EPA Regional Screening Levels (RSLs) in HHRA risk assessment process at Department of Defense Sites and Facilities, Human and Ecological Risk Division, HHRA Note Number 3, May 6. Sacramento, California, June 16.

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OEHHA, 2010, OEHHA Toxicity Criteria Database, California Environmental Protection Agency, <http://www.oehha.ca.gov/risk/chemicaldata/index.asp>.

United States Environmental Protection Agency (U.S. EPA), 2004, Region IX Preliminary Remediation Goals (PRGs), October.

U.S. EPA, 2010a, Integrated Risk Information System (IRIS) on-line database, <http://www.epa.gov/iris>.

U.S. EPA, 2010b, Regional Screening Levels for Chemical Contaminants at Superfund Sites, Regions 3, 6, & 9, Oak Ridge National Laboratory, November, <http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm>.

Van den Berg, M., et al., 2006, The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds, Toxicological Sciences, 93(2): 223-241, October

TABLE C-2

APPORTION METHOD TOXICITY CRITERIA FOR TPH MIXTURES

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Hydrocarbon Range	DTSC-recommended Toxicity Criteria (2009) (RfD_x) RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	RfC (µg/m3)
c5-c8 Aliphatics	0.04	0.2	700
c9-c18 Aliphatics	0.1	0.086	300
c19-c32 Aliphatics	2	--	--
c9-c16 Aromatics	0.004 [2]	0.014	50
c17-c32 Aromatics	0.03	--	--

Chemical	Carbon chains (total number of carbons [HC])[3]	Aliphatic/Aromatic Percentages (A_x)[4] Aliphatics	Aromatics	Percentages Estimated for Each Hydrocarbon Range (P_x) C5-C8 Aliphatics	C9-C18 Aliphatics	C19-C32 Aliphatics	C9-C16 Aromatics	C17-C32 Aromatics	Percent Sum (ΣP)	Normalized Percentages Estimated for Each Hydrocarbon Range (NP_x)[5] C5-C8 Aliphatics	C9-C18 Aliphatics	C19-C32 Aliphatics	C9-C16 Aromatics	C17-C32 Aromatics	Final RfDo (mg/kg-day)	Final RfDi (mg/kg-day)	Final RfC (µg/m³)
TPH as gasoline	c6 to c10 (5)	65%	35%	39%	26%	0%	14%	0%	79%	49%	33%	0%	18%	0%	0.053	0.13	450
TPH as gasoline (in groundwater)	c6 to c12 (7)	65%	35%	28%	37%	0%	20%	0%	85%	33%	44%	0%	24%	0%	--[6]	--[6]	--[6]
TPH as diesel	c10 to c24 (15)	65%	35%	0%	39%	26%	16%	19%	100%	0%	39% / 70%	26% / 0%	16% / 30%	19% / 0%	0.57	0.065	230
TPH as motor oil	c23 to c40 (18)	75%	25%	0%	0%	42%	0%	14%	56%	0%	0%	75%	0%	25%	1.51	--	--
TPH as Stoddard solvent	c7 to c12 (6)	80%	20%	27%	53%	0%	13%	0%	93%	29%	57%	0%	14%	0%	0.069	0.11	380
TEPH (diesel and motor oil)	c10 to c40 (31)	70%	30%	0%	20%	32%	7%	15%	74%	0%	27% / 75%	43% / 0%	9% / 25%	21% / 0%	0.89	0.068	240
c6-c10 hydrocarbons	c6 to c10 (5)	65%	35%	39%	26%	0%	14%	0%	79%	49%	33%	0%	18%	0%	0.053	0.13	450
c10-c20 hydrocarbons	c10 to c20 (11)	65%	35%	0%	53%	12%	22%	13%	100%	0%	53% / 70%	12% / 0%	22% / 30%	13% / 0%	0.29	0.065	230
c10-c28 hydrocarbons	c10 to c28 (19)	65%	35%	0%	31%	34%	13%	22%	100%	0%	31% / 70%	34% / 0%	13% / 30%	22% / 0%	0.72	0.065	230
c21-c28 hydrocarbons	c21 to c28 (8)	65%	35%	0%	0%	65%	0%	35%	100%	0%	0%	65%	0%	35%	1.31	--	--

Equations:

$$P_x = \frac{HC_x}{HC} \times A \qquad NP_x = \frac{P_x}{\sum P_x} \qquad RfD = \sum (NP_x \times RfD_x)$$

See Section 2.1.1

Notes:

1. RfDi calculated from RfC as follows: RfDi = RfC x (0.001 mg/µg) x (20 m3/day)/(70 kg)
2. For sites at which naphthalene and the methylnaphthalenes have been evaluated individually, an RfD of 0.03 mg/kg-day can be used for c9-c16 aromatics per DTSC (2009). Naphthalene has been analyzed for at the Site, but not the methylnaphthalenes. RfDo of 0.004 mg/kg-day therefore used.
3. Carbon chain sizes associated with each non-discrete TPH mixture determined as follows:
   - TPH as gasoline - c6 to c10; approximate composition based on information provided by ATSDR (1999) (c6 to c10-12) and U.S. EPA (1996) (c6 to c10); c6 to c12 used for TPH as gasoline in groundwater based on carbon chain lengths specified in groundwater data tables (Appendix A).
   - TPH as diesel - c10 to c24; approximate composition based on information provided by ATSDR (1999) (c8-12 to c24-26) and U.S. EPA (1996) (c10 to c28)
   - TPH as motor oil - c23 to c40; approximate composition based on information provided by SFRWQCB (2008) (c24 to c40) and Curtis and Thompkins (2009)
   - TPH as Stoddard solvent - c7 to c12; composition provided by ATSDR (1999)
   - TEPH - c12 to c40; approximate composition based on information provided by Curtis and Thompkins (2009)
4. Aliphatic/aromatic percentages associated with each non-discrete TPH mixture determined as follows:
   - TPH as gasoline - composition provided by ATSDR (1999): "...a general hydrocarbon distribution consisting of 4-8% alkanes, 2-5% alkenes, 25-40% isoalkanes, 3-7% cycloalkanes, 1-4% cycloalkenes, and 20-50% aromatics." Assumed 35% aromatic composition as a mid-point.
   - TPH as diesel - composition provided by ATSDR (1999): "The composition consists of approximately 64% aliphatic hydrocarbons (straight chain alkanes and cycloalkanes), 1-2% unsaturated hydrocarbons (alkenes), and 35% aromatic hydrocarbons (including alkylbenzenes and 2-, 3-ring aromatics)."
   - TPH as motor oil - No composition information provided by ATSDR (1999). Used composition information of diesel as surrogate.
   - TPH as Stoddard solvent - composition provided by ATSDR (1999) - "Stoddard solvent consists of 30-50% linear and branched alkanes, 30-40% cycloalkanes, and 10-20% aromatic hydrocarbons." Assumed 80% aliphatic/20% aromatic to be conservative.
   - TEPH - Based on the composition of diesel and motor oil.
   - c6-c10, c10-c20, c10-c28, and c21-c28 hydrocarbons - Used composition information of gasoline or diesel (65% aliphatics, 35% aromatics) as surrogate.
5. A second set of normalized percentages was estimated for TPH as diesel, TEPH, c10-c20 hydrocarbons, and c10-c28 hydrocarbons for use in estimating their respective inhalation RfDs and RfCs to account for the low volatility/lack of inhalation toxicity criteria of the c19-c32 aliphatics and c17-c32 aromatics. The normalized percentages were re-calculated excluding these two groups.
6. Toxicity criteria not developed for TPH as gasoline in groundwater. Normalized percentages estimated to calculate groundwater RBSL as presented in Table C-15.

Abbreviations:

RfC = reference concentration
RfDi = inhalation reference dose
RfDo = oral reference dose
TPH = total petroleum hydrocarbons
-- = Toxicity criteria not available or not developed due to low volatility of the hydrocarbons in the range or mixture. DTSC does not recommend performing a quantitative evaluation of inhalation exposure for c17+ hydrocarbons because of the significant uncertainty involved (DTSC, 2009).

References:

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TABLE C-3

WORST CASE TOXICITY CRITERIA FOR TPH MIXTURES

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Hydrocarbon Range	DTSC-recommended Toxicity Criteria (2009) RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	RfC (µg/m3)
c5-c8 Aliphatics	0.04	0.2	700
c9-c18 Aliphatics	0.1	0.086	300
c19-c32 Aliphatics	2	--	--
c9-c16 Aromatics	0.004 [2]	0.014	50
c17-c32 Aromatics	0.03	--	--

Chemical	Carbon Chains[2]	Most Health-Protective RfD_o		Most Health-Protective RfD_i		Most Health-Protective RfC		**Final Toxicity Criteria (RfD or RfC)**		
		$RfD_{o,al}$ (mg/kg-day)	$RfD_{o,ar}$ (mg/kg-day)	$RfD_{i,al}$ (mg/kg-day)	$RfD_{i,ar}$ (mg/kg-day)	RfC_{al} (µg/m³)	RfC_{ar} (µg/m³)	**RfD_o (mg/kg-day)**	**RfD_i (mg/kg-day)**	**RfC (µg/m³)**
TPH as gasoline	c6 to c10	0.04	0.004	0.086	0.014	300	50	**0.022**	**0.05**	**180**
TPH as diesel	c10 to c24	0.1	0.004	0.086	0.014	300	50	**0.052**	**0.05**	**180**
TPH as motor oil	c23 to c40	2	0.03	--	--	--	--	**1.02**	**--**	**--**
TPH as Stoddard solvent	c7 to c12	0.04	0.004	0.086	0.014	300	50	**0.022**	**0.05**	**180**
TEPH (diesel and motor oil)	c10 to c40	0.1	0.004	0.086	0.014	300	50	**0.052**	**0.05**	**180**
c6-c10 hydrocarbons	c6 to c10	0.04	0.004	0.086	0.014	300	50	**0.022**	**0.05**	**180**
c10-c20 hydrocarbons	c10 to c20	0.1	0.004	0.086	0.014	300	50	**0.052**	**0.05**	**180**
c10-c28 hydrocarbons	c10 to c28	0.1	0.004	0.086	0.014	300	50	**0.052**	**0.05**	**180**
c21-c28 hydrocarbons	c21 to c28	2	0.03	--	--	--	--	**1.02**	**--**	**--**

Notes:
1. RfDi calculated from RfC as follows: RfDi = RfC x (0.001 mg/µg) x (20 m3/day)/(70 kg)
2. For sites at which naphthalene and the methylnaphthalenes have been evaluated individually, an RfD of 0.03 mg/kg-day can be used for c9-c16 aromatics per DTSC (2009). Naphthalene has been analyzed for at the Site, but not the methylnaphthalenes. RfDo of 0.004 mg/kg-day therefore used.
3. Carbon chain groups associated with each non-discrete TPH mixture determined as described in Section 2.1.1 and Table C-2.

Equations:

$$RfD = (0.5 \times RfD_{al}) + (0.5 \times RfD_{ar})$$

See Section 2.1.2.

Abbreviations:
RfC = reference concentration
RfDi = inhalation reference dose
RfDo = oral reference dose
TPH = total petroleum hydrocarbons
-- = Toxicity criteria not available or not developed due to low volatility of the hydrocarbons in the range or mixture. DTSC does not recommend performing a quantitative evaluation of inhalation exposure for c17+ hydrocarbons because of the significant uncertainty involved (DTSC, 2009).

References:
Department of Toxic Substances Control (DTSC), 2009, Evaluating Human Health Risks from Total Petroleum Hydrocarbons (TPH), Interim Guidance, Human and Ecological Risk Division, California Department of Toxic Substances Control, Sacramento, California, June 16.

TABLE C-4

PHYSICOCHEMICAL CONSTANTS FOR CHEMICALS OF POTENTIAL CONCERN

Former Pechiney Cast Plate, Inc. Facility

Vernon, California

Chemical	Log Octanol-Water Coefficient (log Kow) (unitless)	Ref	Henry's Law Constant (H) (atm-m^3/mole)	Ref	Diffusivity in Air (D_i) (cm^2/sec)	Ref	Diffusivity in Water (Dw) (cm^2/sec)	Ref	Organic Carbon Partition Coefficient (Koc) (L/kg)	Ref	Molecular Weight (MW) (g/mole)	Ref	Dermal Soil Absorption (ABSds) --	Ref
Polychlorinated Biphenyls (PCBs)														
Aroclors														
Aroclor-1016	5.13	1	2.9E-04	5	2.2E-02	5	5.4E-06	5	3.3E+04	5	257.9	1	0.15	12
Aroclor-1232	3.20	1	8.6E-04	1	NA	--	7.2E-06	1	6.8E+02	1	221	1	0.15	12
Aroclor-1248	6.06	1	2.9E-03	1	NA	--	6.6E-06	1	4.4E+05	1	288	1	0.15	12
Aroclor-1254	6.04	1	2.0E-03	5	1.6E-02	5	5.0E-06	5	2.0E+05	5	327	1	0.15	12
Aroclor-1260	6.51	1	1.9E-04	5	3.7E-02	5	5.3E-06	5	2.9E+05	5	370	1	0.15	12
Dioxin-like PCB Congeners														
PCB 77	6.72	11	9.4E-06	14	NA	--	NA	--	7.8E+04	14	291.99	14	0.15	12
PCB 81	NA	--	2.2E-04	14	NA	--	NA	--	7.8E+04	14	291.99	14	0.15	12
PCB 105	6.92	11	2.8E-04	14	NA	--	NA	--	1.3E+05	14	326.44	14	0.15	12
PCB 114	NA	--	1.9E-04	14	NA	--	NA	--	1.3E+05	14	326.44	14	0.15	12
PCB 118	NA	--	2.9E-04	14	NA	--	NA	--	1.3E+05	14	326.44	14	0.15	12
PCB 123	NA	--	1.9E-04	14	NA	--	NA	--	1.3E+05	14	326.44	14	0.15	12
PCB 126	NA	--	1.9E-04	14	NA	--	NA	--	1.3E+05	14	326.44	14	0.15	12
PCB 156, 157	NA	--	1.4E-04	14	NA	--	NA	--	2.1E+05	14	360.88	14	0.15	12
PCB 167	NA	--	1.6E-04	14	NA	--	NA	--	2.1E+05	14	360.88	14	0.15	12
PCB 169	NA	--	1.6E-04	14	NA	--	NA	--	2.1E+05	14	360.88	14	0.15	12
PCB 189	NA	--	1.4E-04	14	NA	--	NA	--	3.5E+05	14	395.33	14	0.15	12
Dioxin-like PCB Congeners (TEQ)	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	0.15	12
Metals														
Arsenic	NA	--	NA	--	NA	--	NA	--	NA	--	75	4	0.04	2
Barium	NA	--	NA	--	NA	--	NA	--	NA	--	137	4	0.01	3
Beryllium	NA	--	NA	--	NA	--	NA	--	NA	--	9.01	4	0.01	3
Cadmium	NA	--	NA	--	NA	--	NA	--	NA	--	112	4	0.001	8
Chromium (total)	NA	--	NA	--	NA	--	NA	--	NA	--	52	4	0.01	3
Chromium VI	NA	--	NA	--	NA	--	NA	--	NA	--	52	4	0.01	3
Cobalt	NA	--	NA	--	NA	--	NA	--	NA	--	59	4	0.01	3
Copper	NA	--	NA	--	NA	--	NA	--	NA	--	64	4	0.01	3
Lead	NA	--	NA	--	NA	--	NA	--	NA	--	207.2	4	0.01	3
Mercury	NA	--	1.1E-02	6	3.1E-02	6	6.3E-06	6	5.2E+01	6	200.59	6	0.1	3
Molybdenum	NA	--	NA	--	NA	--	NA	--	NA	--	95.94	4	0.01	3
Nickel	NA	--	NA	--	NA	--	NA	--	NA	--	59	4	0.0002	2
Selenium	NA	--	NA	--	NA	--	NA	--	NA	--	79	4	0.01	3
Silver	NA	--	NA	--	NA	--	NA	--	NA	--	108	4	0.01	3
Thallium	NA	--	NA	--	NA	--	NA	--	NA	--	204	4	0.01	3
Vanadium	NA	--	NA	--	NA	--	NA	--	NA	--	51	4	0.01	3
Zinc	NA	--	NA	--	NA	--	NA	--	NA	--	65	4	0.01	3
Aliphatic and Aromatic Hydrocarbons														
c5-c8 Aliphatics	NA	--	8.0E-01	13	1.0E-01	13	1.0E-05	13	4.0E+03	13	NA	--	NA	--
c9-c18 Aliphatics	NA	--	1.9E+00	13	1.0E-01	13	1.0E-05	13	2.5E+05	13	NA	--	NA	--
c9-c16 Aromatics	NA	--	1.2E-02	13	1.0E-01	13	1.0E-05	13	2.5E+03	13	NA	--	NA	--
Volatile Organic Compounds (VOCs)														
Acetone	-0.24	10	3.9E-05	6	1.2E-01	6	1.1E-05	6	5.8E-01	6	58.08	6	0.1	3
Benzene	2.13	10	5.5E-03	6	8.8E-02	6	9.8E-06	6	5.9E+01	6	78.11	6	0.1	3
2-Butanone (MEK)	0.40	1	5.6E-05	10	8.1E-02	8	9.8E-06	6	2.3E+00	6	72.11	6	0.1	3
n-Butylbenzene	4.35	1	1.3E-02	6	5.7E-02	6	8.1E-06	6	1.1E+03	6	134.22	6	0.1	3
sec-Butylbenzene	4.24	1	1.4E-02	6	5.7E-02	6	8.1E-06	6	9.7E+02	6	134.22	6	0.1	3
Carbon Tetrachloride	2.73	3	3.0E-02	10	7.8E-02	8	8.8E-06	6	1.7E+02	6	153.82	6	0.1	3
Chloroform	1.92	10	3.7E-03	6	1.0E-01	6	1.0E-05	6	4.0E+01	6	119.38	6	0.1	3
1,2-Dichloroethane (EDC)	1.47	3	9.8E-04	10	1.0E-01	8	9.9E-06	6	1.7E+01	6	98.96	6	0.1	3
1,1-Dichloroethylene	2.13	10	2.6E-02	6	9.0E-02	6	1.0E-05	6	5.9E+01	6	96.94	6	0.1	3
cis-1,2-Dichloroethylene	1.86	3	4.1E-03	10	7.4E-02	8	1.1E-05	8	3.6E+01	8	96.94	8	0.1	3

TABLE C-4

PHYSICOCHEMICAL CONSTANTS FOR CHEMICALS OF POTENTIAL CONCERN

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Chemical	Log Octanol-Water Coefficient (log Kow) (unitless)	Ref	Henry's Law Constant (H) (atm-m^3/mole)	Ref	Diffusivity in Air (D_i) (cm^2/sec)	Ref	Diffusivity in Water (Dw) (cm^2/sec)	Ref	Organic Carbon Partition Coefficient (Koc) (L/kg)	Ref	Molecular Weight (MW) (g/mole)	Ref	Dermal Soil Absorption (ABSds) --	Ref
Ethylbenzene	3.14	10	7.9E-03	6	7.5E-02	6	7.8E-06	6	3.6E+02	6	106.17	6	0.1	3
Isopropylbenzene	3.60	1	1.2E+00	6	6.5E-02	6	7.1E-06	6	4.9E+02	6	120.19	6	0.1	3
Isopropyltoluene	4.10	7	1.1E-02	11	5.6E-02	7	7.3E-06	7	4.1E+03	11	134.22	4	0.1	3
Naphthalene	3.36	10	4.8E-04	6	5.9E-02	6	7.5E-06	6	2.0E+03	6	128.18	6	0.1	3
n-Propylbenzene	3.62	1	1.1E-02	6	6.0E-02	6	7.8E-06	6	5.6E+02	6	120.19	6	0.1	3
Tetrachloroethylene (PCE)	2.67	10	1.8E-02	6	7.2E-02	6	8.2E-06	6	1.6E+02	6	165.83	6	0.1	3
Toluene	2.75	10	6.6E-03	6	8.7E-02	6	8.6E-06	6	1.8E+02	6	92.14	6	0.1	3
1,1,1-Trichloroethane	2.48	10	1.7E-02	6	7.8E-02	6	8.8E-06	6	1.1E+02	6	133.4	6	0.1	3
Trichloroethylene (TCE)	2.71	10	1.0E-02	6	7.9E-02	6	9.1E-06	6	1.7E+02	6	131.39	6	0.1	3
1,2,4-Trimethylbenzene	3.72	1	6.1E-03	6	6.1E-02	6	7.9E-06	6	1.4E+03	6	120.2	6	0.1	3
1,3,5-Trimethylbenzene	3.54	1	5.9E-03	6	6.0E-02	6	8.7E-06	6	1.4E+03	6	120.2	6	0.1	3
Total Xylenes	3.17	10	7.3E-03	9	7.0E-02	9	7.9E-06	9	2.0E+02	9	106.17	9	0.1	3
m,p-Xylenes	3.20	1	7.6E-03	6	7.7E-02	6	8.4E-06	6	3.9E+02	6	106.17	6	0.1	3
o-Xylene	3.13	1	5.2E-03	6	8.7E-02	6	1.0E-05	6	3.6E+02	6	106.17	6	0.1	3

Notes:

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Abbreviations:

atm-m^3/mole = atmospheres - cubic meter per mole
cm^2/sec = square centimeters per second
g/mole = grams per mole
L/kg = liters per kilogram
NA = not available
Ref = reference
-- = not applicable

TABLE C-5
EXPOSURE PARAMETERS USED IN DEVELOPING RISK-BASED SCREENING LEVELS FOR OUTDOOR COMMERCIAL/INDUSTRIAL WORKERS
Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Exposure Parameter	Units	Value
GENERAL EXPOSURE PARAMETERS		
Exposure Frequency (EF)	days/year	250
Exposure Duration (ED)	years	25
Body Weight (BW)	kg	70
Averaging Time (AT)	days	25,550 (carcinogens) 9,125 (noncarcinogens)
PATHWAY-SPECIFIC PARAMETERS		
Incidental Soil Ingestion		
Soil Ingestion Rate (IR_s)	mg/day	100
Dermal Contact with Soil		
Exposed Skin Surface Area (SA_s)	cm^2/day	5,700
Soil-to-Skin Adherence Factor (SAF)	mg/cm^2	0.2
Absorption Fraction (ABSds)	unitless	Chemical-specific (see Table C-4)
Inhalation of Suspended Soil Particulates		
Inhalation Rate (IHR_a)	m^3/day	14 (over an 8 hour workday)
Particulate Emission Factor (PEF)	m^3/kg	1.32×10^9
Inhalation of Vapors in Outdoor Air		
Inhalation Rate (IHR_a)	m^3/day	14 (over an 8 hour workday)

Abbreviations:
cm^2/day = centimeters squared per day
kg = kilograms
m^3/day = cubic meters per day
m^3/kg = cubic meters per kilogram
mg/cm^2 = milligrams per squared centimeters
mg/day = milligrams per day

TABLE C-6
EXPOSURE PARAMETERS USED IN DEVELOPING RISK-BASED SCREENING LEVELS FOR CONSTRUCTION WORKERS
Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Exposure Parameter	Units	Value
GENERAL EXPOSURE PARAMETERS		
Exposure Frequency (EF)	days/year	250
Exposure Duration (ED)	years	1
Body Weight (BW)	kg	70
Averaging Time (AT)	days	25,550 (carcinogens) 365 (noncarcinogens)
Pathway-Specific Parameters		
Incidental Soil Ingestion		
Soil Ingestion Rate (IR_s)	mg/day	330
Dermal Contact with Soil		
Exposed Skin Surface Area (SA_s)	cm^2/day	5,700
Soil-to-Skin Adherence Factor (SAF)	mg/cm^2	0.8
Absorption Fraction (ABSds)	unitless	Chemical-specific (see Table C-4)
Inhalation of Vapors in Ambient Air		
Inhalation Rate (IHR_a)	m^3/day	20 (over an 8 hour workday)
Inhalation of Suspended Soil Particulates		
Particulate Emission Factor (PEF)	m^3/kg	$1.0x10^6$
Inhalation Rate (IHR_a)	m^3/day	20 (over an 8 hour workday)

Abbreviations:
cm^2/day = centimeters squared per day
kg = kilograms
m^3/day = cubic meters per day
m^3/kg = cubic meters per kilogram
mg/cm^2 = milligrams per squared centimeters
mg/day = milligrams per day

TABLE C-7

RISK-BASED SCREENING LEVELS FOR CHEMICALS OF POTENTIAL CONCERN IN SOIL - OUTDOOR COMMERCIAL/INDUSTRIAL WORKER

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Chemical	Oral Cancer Slope Factor (CSF_o) $(mg/kg\text{-}day)^{-1}$	Dermal Cancer Slope Factor (CSFd) $(mg/kg\text{-}day)^{-1}$	Inhalation Cancer Slope Factor (CSF_i) $(mg/kg\text{-}day)^{-1}$	Oral Reference Dose (RfDo) (mg/kg-day)	Dermal Reference Dose (RfDd) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Absorption Factor ABS (--)	Molecular Weight (g/mole)	Henry's Law Constant ($atm\text{-}m^3/mole$)	VOC? [2]	Soil RBSL[1] -- Outdoor Commercial/Industrial Cancer (mg/kg)	Noncancer (mg/kg)
Polychlorinated Biphenyls (PCBs)												
Aroclors												
Aroclor-1016	2	2	2	7.00E-05	7.00E-05	7.00E-05	0.15	2.6E+02	2.9E-04	No	5.3E-01	2.6E+01
Aroclor-1232	2	2	2	NA	NA	NA	0.15	2.2E+02	8.6E-04	No	5.3E-01	--
Aroclor-1248	2	2	2	NA	NA	NA	0.15	2.9E+02	2.9E-03	No	5.3E-01	--
Aroclor-1254	2	2	2	2.00E-05	2.00E-05	2.00E-05	0.15	3.3E+02	2.0E-03	No	5.3E-01	7.5E+00
Aroclor-1260	2	2	2	NA	NA	NA	0.15	3.7E+02	1.9E-04	No	5.3E-01	--
Dioxin-like PCB Congeners												
PCB 77	13	13	13	1.00E-05	1.00E-05	1.14E-04	0.15	2.9E+02	9.4E-06	No	8.1E-02	3.8E+00
PCB 81	39	39	39	3.33E-06	3.33E-06	3.81E-05	0.15	2.9E+02	2.2E-04	No	2.7E-02	1.3E+00
PCB 105	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.3E+02	2.8E-04	No	2.7E-01	1.3E+01
PCB 114	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.3E+02	1.9E-04	No	2.7E-01	1.3E+01
PCB 118	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.3E+02	2.9E-04	No	2.7E-01	1.3E+01
PCB 123	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.3E+02	1.9E-04	No	2.7E-01	1.3E+01
PCB 126	13,000	13,000	13,000	1.00E-08	1.00E-08	1.14E-07	0.15	3.3E+02	1.9E-04	No	8.1E-05	3.8E-03
PCB 156, 157	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.6E+02	1.4E-04	No	2.7E-01	1.3E+01
PCB 167	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.6E+02	1.6E-04	No	2.7E-01	1.3E+01
PCB 169	3900	3900	3900	3.33E-08	3.33E-08	3.81E-07	0.15	3.6E+02	1.6E-04	No	2.7E-04	1.3E-02
PCB 189	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	4.0E+02	1.4E-04	No	2.7E-01	1.3E+01
Dioxin-like PCB Congeners (TEQ)	130,000	130,000	130,000	1.00E-09	1.00E-09	1.14E-08	0.15	NA	NA	No	8.1E-06	3.8E-04
Metals												
Arsenic	1.5	1.5	12	3.00E-04	3.00E-04	4.29E-06	0.04	7.5E+01	NA	No	1.3E+00	2.1E+02
Barium	NC	NC	NC	2.00E-01	2.00E-01	1.43E-04	0.01	1.4E+02	NA	No	NC	1.6E+05
Cadmium	NA	NA	15	5.00E-04	5.00E-04	5.71E-06	0.001	1.1E+02	NA	No	1.8E+03	5.0E+02
Chromium (total)	NA	NA	42	1.50E+00	1.50E+00	1.50E+00	0.01	5.2E+01	NA	No	6.4E+02	1.4E+06
Cobalt	NA	NA	31.5	3.00E-04	3.00E-04	1.71E-06	0.01	5.9E+01	NA	No	8.5E+02	2.7E+02
Copper	NC	NC	NC	4.00E-02	4.00E-02	3.70E-02	0.01	6.4E+01	NA	No	NC	3.7E+04
Mercury	NA	NA	NA	3.00E-04	3.00E-04	8.57E-06	0.1	2.0E+02	1.1E-02	No	--	1.4E+02
Molybdenum	NA	NA	NA	5.00E-03	5.00E-03	5.00E-03	0.01	9.6E+01	NA	No	--	4.6E+03
Nickel	NA	NA	0.91	2.00E-02	2.00E-02	1.43E-05	0.0002	5.9E+01	NA	No	3.0E+04	1.8E+04
Silver	NC	NC	NC	5.00E-03	5.00E-03	5.00E-03	0.01	1.1E+02	NA	No	NC	4.6E+03
Thallium	NA	NA	NA	6.50E-05	6.50E-05	8.00E-05	0.01	2.0E+02	NA	No	--	6.0E+01
Vanadium	NA	NA	NA	7.00E-03	7.00E-03	7.00E-03	0.01	5.1E+01	NA	No	--	6.4E+03
Zinc	NC	NC	NC	3.00E-01	3.00E-01	3.00E-01	0.01	6.5E+01	NA	No	NC	2.8E+05

TABLE C-7

RISK-BASED SCREENING LEVELS FOR CHEMICALS OF POTENTIAL CONCERN IN SOIL - OUTDOOR COMMERCIAL/INDUSTRIAL WORKER

Former Pechiney Cast Plate, Inc. Facility

Vernon, California

Chemical	Oral Cancer Slope Factor (CSF_o) (mg/kg-day)$^{-1}$	Dermal Cancer Slope Factor (CSFd) (mg/kg-day)$^{-1}$	Inhalation Cancer Slope Factor (CSF_i) (mg/kg-day)$^{-1}$	Oral Reference Dose (RfDo) (mg/kg-day)	Dermal Reference Dose (RfDd) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Absorption Factor ABS (--)	Molecular Weight (g/mole)	Henry's Law Constant (atm-m^3/mole)	VOC? [2]	Soil RBSL[1] -- Outdoor Commercial/Industrial Cancer (mg/kg)	Soil RBSL[1] -- Outdoor Commercial/Industrial Noncancer (mg/kg)
Total Petroleum Hydrocarbons (Apportion Method)												
TPH as gasoline	NA	NA	NA	5.30E-02	5.30E-02	1.30E-01	0.1	NA	NA	Yes	--	2.5E+04
TPH as diesel	NA	NA	NA	5.70E-01	5.70E-01	6.50E-02	0.1	NA	NA	No	--	2.7E+05
TPH as motor oil	NA	NA	NA	1.51E+00	1.51E+00	NA	0.1	NA	NA	No	--	7.2E+05
TPH as Stoddard solvent	NA	NA	NA	6.90E-02	6.90E-02	1.10E-01	0.1	NA	NA	Yes	--	3.3E+04
TEPH	NA	NA	NA	8.90E-01	8.90E-01	6.80E-02	0.1	NA	NA	No	--	4.2E+05
c6-c10 hydrocarbons	NA	NA	NA	5.30E-02	5.30E-02	1.30E-01	0.1	NA	NA	Yes	--	2.5E+04
c10-c20 hydrocarbons	NA	NA	NA	2.90E-01	2.90E-01	6.50E-02	0.1	NA	NA	No	--	1.4E+05
c10-c28 hydrocarbons	NA	NA	NA	7.20E-01	7.20E-01	6.50E-02	0.1	NA	NA	No	--	3.4E+05
c21-c28 hydrocarbons	NA	NA	NA	1.31E+00	1.31E+00	NA	0.1	NA	NA	No	--	6.3E+05
Total Petroleum Hydrocarbons (Worst Case)												
TPH as gasoline	NA	NA	NA	2.20E-02	2.20E-02	5.00E-02	0.1	NA	NA	Yes	--	1.1E+04
TPH as diesel	NA	NA	NA	5.20E-02	5.20E-02	5.00E-02	0.1	NA	NA	No	--	2.5E+04
TPH as motor oil	NA	NA	NA	1.02E+00	1.02E+00	NA	0.1	NA	NA	No	--	4.9E+05
TPH as Stoddard solvent	NA	NA	NA	2.20E-02	2.20E-02	5.00E-02	0.1	NA	NA	Yes	--	1.1E+04
TEPH	NA	NA	NA	5.20E-02	5.20E-02	5.00E-02	0.1	NA	NA	No	--	2.5E+04
c6-c10 hydrocarbons	NA	NA	NA	2.20E-02	2.20E-02	5.00E-02	0.1	NA	NA	Yes	--	1.1E+04
c10-c20 hydrocarbons	NA	NA	NA	5.20E-02	5.20E-02	5.00E-02	0.1	NA	NA	No	--	2.5E+04
c10-c28 hydrocarbons	NA	NA	NA	5.20E-02	5.20E-02	5.00E-02	0.1	NA	NA	No	--	2.5E+04
c21-c28 hydrocarbons	NA	NA	NA	1.02E+00	1.02E+00	NA	0.1	NA	NA	No	--	4.9E+05
Volatile Organic Compounds (VOCs)[3]												
Acetone	NA	NA	NA	9.00E-01	9.00E-01	8.86E+00	0.1	5.8E+01	3.9E-05	Yes	--	4.3E+05
Benzene	0.1	0.1	0.1	4.00E-03	4.00E-03	1.71E-02	0.1	7.8E+01	5.5E-03	Yes	1.3E+01	1.9E+03
n-Butylbenzene	NA	NA	NA	4.00E-02	4.00E-02	4.00E-02	0.1	1.3E+02	1.3E-02	Yes	--	1.9E+04
sec-Butylbenzene	NA	NA	NA	4.00E-02	4.00E-02	4.00E-02	0.1	1.3E+02	1.4E-02	Yes	--	1.9E+04
Ethylbenzene	0.011	0.011	0.0087	1.00E-01	1.00E-01	5.71E-01	0.1	1.1E+02	7.9E-03	Yes	1.2E+02	4.8E+04
Isopropylbenzene	NC	NC	NC	1.00E-01	1.00E-01	1.14E-01	0.1	1.2E+02	1.2E+00	Yes	NC	4.8E+04
Isopropyltoluene	NC	NC	NC	1.00E-01	1.00E-01	1.14E-01	0.1	1.3E+02	1.1E-02	Yes	NC	4.8E+04
Naphthalene	NA	NA	0.12	2.00E-02	2.00E-02	2.57E-03	0.1	1.3E+02	4.8E-04	Yes	--	9.6E+03
n-Propylbenzene	NA	NA	NA	4.00E-02	4.00E-02	4.00E-02	0.1	1.2E+02	1.1E-02	Yes	--	1.9E+04
Tetrachloroethylene (PCE)	0.54	0.54	0.021	1.00E-02	1.00E-02	1.00E-02	0.1	1.7E+02	1.8E-02	Yes	2.5E+00	4.8E+03
Toluene	NA	NA	NA	8.00E-02	8.00E-02	8.57E-02	0.1	9.2E+01	6.6E-03	Yes	--	3.8E+04
Trichloroethylene (TCE)	0.0059	0.0059	0.007	3.00E-04	3.00E-04	1.71E-01	0.1	1.3E+02	1.0E-02	Yes	2.3E+02	1.4E+02

TABLE C-7

RISK-BASED SCREENING LEVELS FOR CHEMICALS OF POTENTIAL CONCERN IN SOIL - OUTDOOR COMMERCIAL/INDUSTRIAL WORKER

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Chemical	Oral Cancer Slope Factor (CSF_o) (mg/kg-day)$^{-1}$	Dermal Cancer Slope Factor (CSFd) (mg/kg-day)$^{-1}$	Inhalation Cancer Slope Factor (CSF_i) (mg/kg-day)$^{-1}$	Oral Reference Dose (RfDo) (mg/kg-day)	Dermal Reference Dose (RfDd) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Absorption Factor ABS (--)	Molecular Weight (g/mole)	Henry's Law Constant (atm-m^3/mole)	VOC? [2]	Soil RBSL[1] -- Outdoor Commercial/Industrial: Cancer (mg/kg)	Soil RBSL[1] -- Outdoor Commercial/Industrial: Noncancer (mg/kg)
1,2,4-Trimethylbenzene	NA	NA	NA	5.00E-02	5.00E-02	2.00E-03	0.1	1.2E+02	6.1E-03	Yes	--	2.4E+04
1,3,5-Trimethylbenzene	NA	NA	NA	5.00E-02	5.00E-02	1.71E-03	0.1	1.2E+02	5.9E-03	Yes	--	2.4E+04
Total Xylenes	NA	NA	NA	2.00E-01	2.00E-01	2.00E-01	0.1	1.1E+02	7.3E-03	Yes	--	9.6E+04
m/p-Xylenes	NA	NA	NA	2.00E-01	2.00E-01	2.00E-01	0.1	1.1E+02	7.6E-03	Yes	--	9.6E+04
o-Xylene	NA	NA	NA	2.00E-01	2.00E-01	2.00E-01	0.1	1.1E+02	5.2E-03	Yes	--	9.6E+04

Notes:

1. Risk-based screening levels (RBSL) calculated using the methodology presented by OEHHA, 2005, Human-Exposed-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil, January.
2. Chemicals identified as a volatile organic compound (VOC) if the molecular weight is less than 200 g/mole and the Henry's Law Constant is greater than $1x10^{-5}$ atm-m^3/mole. Volatile TPH identified on the basis of analytical methods for the TPH mixture in soil vapor. The inhalation pathway is not evaluated in the RBSL for VOCs in soil. A particulate emission factor (PEF) of $1.316x10^9$ m^3/kg is used in the derivation of RBSLs for all non-volatile chemicals.
3. Inhalation pathway not incorporated into the development of soil RBSLs for VOCs. Volatilization of chemicals from the subsurface to ambient air evaluated using RBSLs developed for soil vapor (Table C-12).

Abbreviations:

atm-m^3/mole = atmospheres - cubic meter per mole
g/mole = grams per mole
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram - day
NA = not available
NC = noncarcinogenic
-- = not applicable

Equations:

$$RBSL_{soil-risk} = \frac{TR \times BW \times AT_{ca}}{ED \times EF \times \left[\left(\frac{IR_s \times CSF_o}{CF_{kg-mg}}\right) + \left(\frac{SAs \times SAF \times ABS \times CSF_o}{CF_{kg-mg}}\right) + \left(\frac{IHR_a \times CSF_i}{PEF}\right)\right]}$$

$$RBSL_{soil-haz} = \frac{THQ \times BW \times AT_{nc}}{ED \times EF \times \left[\left(\frac{1}{RfD_o} \times \frac{IR_s}{CF_{kg-mg}}\right) + \left(\frac{1}{RfD_o} \times \frac{SAs \times SAF \times ABS}{CF_{kg-mg}}\right) + \left(\frac{1}{RfD_i} \times \frac{IHR_a}{PEF}\right)\right]}$$

See Section 3.1

TABLE C-8

RISK-BASED SCREENING LEVELS FOR CHEMICALS OF POTENTIAL CONCERN IN SOIL - CONSTRUCTION WORKER

Former Pechiney Cast Plate, Inc. Facility

Vernon, California

Chemical	Oral Cancer Slope Factor (CSF_o) $(mg/kg\text{-}day)^{-1}$	Dermal Cancer Slope Factor (CSFd) $(mg/kg\text{-}day)^{-1}$	Inhalation Cancer Slope Factor (CSF_i) $(mg/kg\text{-}day)^{-1}$	Oral Reference Dose (RfDo) (mg/kg-day)	Dermal Reference Dose (RfDd) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Absorption Factor ABS (--)	Molecular Weight (g/mole)	Henry's Law Constant ($atm\text{-}m^3/mole$)	VOC? [2]	Soil RBSL[1] -- Construction Worker: Cancer (mg/kg)	Noncancer (mg/kg)
Polychlorinated Biphenyls (PCBs)												
Aroclors												
Aroclor-1016	2	2	2	7.00E-05	7.00E-05	7.00E-05	0.15	2.6E+02	2.9E-04	No	3.5E+00	6.9E+00
Aroclor-1232	2	2	2	NA	NA	NA	0.15	2.2E+02	8.6E-04	No	3.5E+00	--
Aroclor-1248	2	2	2	NA	NA	NA	0.15	2.9E+02	2.9E-03	No	3.5E+00	--
Aroclor-1254	2	2	2	2.00E-05	2.00E-05	2.00E-05	0.15	3.3E+02	2.0E-03	No	3.5E+00	2.0E+00
Aroclor-1260	2	2	2	NA	NA	NA	0.15	3.7E+02	1.9E-04	No	3.5E+00	--
Dioxin-like PCB Congeners												
PCB 77	13	13	13	1.00E-05	1.00E-05	1.14E-04	0.15	2.9E+02	9.4E-06	No	5.3E-01	1.0E+00
PCB 81	39	39	39	3.33E-06	3.33E-06	3.81E-05	0.15	2.9E+02	2.2E-04	No	1.8E-01	3.4E-01
PCB 105	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.3E+02	2.8E-04	No	1.8E+00	3.4E+00
PCB 114	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.3E+02	1.9E-04	No	1.8E+00	3.4E+00
PCB 118	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.3E+02	2.9E-04	No	1.8E+00	3.4E+00
PCB 123	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.3E+02	1.9E-04	No	1.8E+00	3.4E+00
PCB 126	13,000	13,000	13,000	1.00E-08	1.00E-08	1.14E-07	0.15	3.3E+02	1.9E-04	No	5.3E-04	1.0E-03
PCB 156, 157	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.6E+02	1.4E-04	No	1.8E+00	3.4E+00
PCB 167	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	3.6E+02	1.6E-04	No	1.8E+00	3.4E+00
PCB 169	3900	3900	3900	3.33E-08	3.33E-08	3.81E-07	0.15	3.6E+02	1.6E-04	No	1.8E-03	3.4E-03
PCB 189	3.9	3.9	3.9	3.33E-05	3.33E-05	3.81E-04	0.15	4.0E+02	1.4E-04	No	1.8E+00	3.4E+00
Dioxin-like PCB Congeners (TEQ)	130,000	130,000	130,000	1.00E-09	1.00E-09	1.14E-08	0.15	NA	NA	No	5.3E-05	1.0E-04
Metals												
Arsenic	1.5	1.5	12	3.00E-04	3.00E-04	4.29E-06	0.04	7.5E+01	NA	No	7.1E+00	1.6E+01
Barium	NC	NC	NC	2.00E-01	2.00E-01	1.43E-04	0.01	1.4E+02	NA	No	NC	7.2E+02
Cadmium	NA	NA	15	5.00E-04	5.00E-04	5.71E-06	0.001	1.1E+02	NA	No	2.4E+01	2.5E+01
Chromium (total)	NA	NA	42	1.50E+00	1.50E+00	1.50E+00	0.01	5.2E+01	NA	No	8.5E+00	3.9E+05
Cobalt	NA	NA	31.5	3.00E-04	3.00E-04	1.71E-06	0.01	5.9E+01	NA	No	1.1E+01	7.9E+00
Copper	NC	NC	NC	4.00E-02	4.00E-02	3.70E-02	0.01	6.4E+01	NA	No	NC	1.0E+04
Mercury	NA	NA	NA	3.00E-04	3.00E-04	8.57E-06	0.1	2.0E+02	1.1E-02	No	--	2.1E+01
Molybdenum	NA	NA	NA	5.00E-03	5.00E-03	5.00E-03	0.01	9.6E+01	NA	No	--	1.3E+03
Nickel	NA	NA	0.91	2.00E-02	2.00E-02	1.43E-05	0.0002	5.9E+01	NA	No	3.9E+02	7.2E+01
Silver	NC	NC	NC	5.00E-03	5.00E-03	5.00E-03	0.01	1.1E+02	NA	No	NC	1.3E+03
Thallium	NA	NA	NA	6.50E-05	6.50E-05	8.00E-05	0.01	2.0E+02	NA	No	--	1.7E+01
Vanadium	NA	NA	NA	7.00E-03	7.00E-03	7.00E-03	0.01	5.1E+01	NA	No	--	1.8E+03
Zinc	NC	NC	NC	3.00E-01	3.00E-01	3.00E-01	0.01	6.5E+01	NA	No	NC	7.8E+04

TABLE C-8

RISK-BASED SCREENING LEVELS FOR CHEMICALS OF POTENTIAL CONCERN IN SOIL - CONSTRUCTION WORKER

Former Pechiney Cast Plate, Inc. Facility

Vernon, California

Chemical	Oral Cancer Slope Factor (CSF_o) (mg/kg-day)$^{-1}$	Dermal Cancer Slope Factor (CSFd) (mg/kg-day)$^{-1}$	Inhalation Cancer Slope Factor (CSF_i) (mg/kg-day)$^{-1}$	Oral Reference Dose (RfDo) (mg/kg-day)	Dermal Reference Dose (RfDd) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Absorption Factor ABS (--)	Molecular Weight (g/mole)	Henry's Law Constant (atm-m^3/mole)	VOC? [2]	Soil RBSL[1] -- Construction Worker: Cancer (mg/kg)	Soil RBSL[1] -- Construction Worker: Noncancer (mg/kg)
Total Petroleum Hydrocarbons (Apportion Method)												
TPH as gasoline	NA	NA	NA	5.30E-02	5.30E-02	1.30E-01	0.1	NA	NA	Yes	--	6.9E+03
TPH as diesel	NA	NA	NA	5.70E-01	5.70E-01	6.50E-02	0.1	NA	NA	No	--	6.1E+04
TPH as motor oil	NA	NA	NA	1.51E+00	1.51E+00	NA	0.1	NA	NA	No	--	2.0E+05
TPH as Stoddard solvent	NA	NA	NA	6.90E-02	6.90E-02	1.10E-01	0.1	NA	NA	Yes	--	9.0E+03
TEPH	NA	NA	NA	8.90E-01	8.90E-01	6.80E-02	0.1	NA	NA	No	--	8.7E+04
c6-c10 hydrocarbons	NA	NA	NA	5.30E-02	5.30E-02	1.30E-01	0.1	NA	NA	Yes	--	6.9E+03
c10-c20 hydrocarbons	NA	NA	NA	2.90E-01	2.90E-01	6.50E-02	0.1	NA	NA	No	--	3.4E+04
c10-c28 hydrocarbons	NA	NA	NA	7.20E-01	7.20E-01	6.50E-02	0.1	NA	NA	No	--	7.3E+04
c21-c28 hydrocarbons	NA	NA	NA	1.31E+00	1.31E+00	NA	0.1	NA	NA	No	--	1.7E+05
Total Petroleum Hydrocarbons (Worst Case)												
TPH as gasoline	NA	NA	NA	2.20E-02	2.20E-02	5.00E-02	0.1	NA	NA	Yes	--	2.9E+03
TPH as diesel	NA	NA	NA	5.20E-02	5.20E-02	5.00E-02	0.1	NA	NA	No	--	6.6E+03
TPH as motor oil	NA	NA	NA	1.02E+00	1.02E+00	NA	0.1	NA	NA	No	--	1.3E+05
TPH as Stoddard solvent	NA	NA	NA	2.20E-02	2.20E-02	5.00E-02	0.1	NA	NA	Yes	--	2.9E+03
TEPH	NA	NA	NA	5.20E-02	5.20E-02	5.00E-02	0.1	NA	NA	No	--	6.6E+03
c6-c10 hydrocarbons	NA	NA	NA	2.20E-02	2.20E-02	5.00E-02	0.1	NA	NA	Yes	--	2.9E+03
c10-c20 hydrocarbons	NA	NA	NA	5.20E-02	5.20E-02	5.00E-02	0.1	NA	NA	No	--	6.6E+03
c10-c28 hydrocarbons	NA	NA	NA	5.20E-02	5.20E-02	5.00E-02	0.1	NA	NA	No	--	6.6E+03
c21-c28 hydrocarbons	NA	NA	NA	1.02E+00	1.02E+00	NA	0.1	NA	NA	No	--	1.3E+05
Volatile Organic Compounds (VOCs) [3]												
Acetone	NA	NA	NA	9.00E-01	9.00E-01	8.86E+00	0.1	5.8E+01	3.9E-05	Yes	--	1.2E+05
Benzene	0.1	0.1	0.1	4.00E-03	4.00E-03	1.71E-02	0.1	7.8E+01	5.5E-03	Yes	9.1E+01	5.2E+02
n-Butylbenzene	NA	NA	NA	4.00E-02	4.00E-02	4.00E-02	0.1	1.3E+02	1.3E-02	Yes	--	5.2E+03
sec-Butylbenzene	NA	NA	NA	4.00E-02	4.00E-02	4.00E-02	0.1	1.3E+02	1.4E-02	Yes	--	5.2E+03
Ethylbenzene	0.011	0.011	0.0087	1.00E-01	1.00E-01	5.71E-01	0.1	1.1E+02	7.9E-03	Yes	8.3E+02	1.3E+04
Isopropylbenzene	NC	NC	NC	1.00E-01	1.00E-01	1.14E-01	0.1	1.2E+02	1.2E+00	Yes	NC	1.3E+04
Isopropyltoluene	NC	NC	NC	1.00E-01	1.00E-01	1.14E-01	0.1	1.3E+02	1.1E-02	Yes	NC	1.3E+04
Naphthalene	NA	NA	0.12	2.00E-02	2.00E-02	2.57E-03	0.1	1.3E+02	4.8E-04	Yes	--	2.6E+03
n-Propylbenzene	NA	NA	NA	4.00E-02	4.00E-02	4.00E-02	0.1	1.2E+02	1.1E-02	Yes	--	5.2E+03
Tetrachloroethylene (PCE)	0.54	0.54	0.021	1.00E-02	1.00E-02	1.00E-02	0.1	1.7E+02	1.8E-02	Yes	1.7E+01	1.3E+03
Toluene	NA	NA	NA	8.00E-02	8.00E-02	8.57E-02	0.1	9.2E+01	6.6E-03	Yes	--	1.0E+04
Trichloroethylene (TCE)	0.0059	0.0059	0.007	3.00E-04	3.00E-04	1.71E-01	0.1	1.3E+02	1.0E-02	Yes	1.5E+03	3.9E+01
1,2,4-Trimethylbenzene	NA	NA	NA	5.00E-02	5.00E-02	2.00E-03	0.1	1.2E+02	6.1E-03	Yes	--	6.5E+03
1,3,5-Trimethylbenzene	NA	NA	NA	5.00E-02	5.00E-02	1.71E-03	0.1	1.2E+02	5.9E-03	Yes	--	6.5E+03

TABLE C-8

RISK-BASED SCREENING LEVELS FOR CHEMICALS OF POTENTIAL CONCERN IN SOIL - CONSTRUCTION WORKER

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Chemical	Oral Cancer Slope Factor (CSF_o) (mg/kg-day)$^{-1}$	Dermal Cancer Slope Factor (CSFd) (mg/kg-day)$^{-1}$	Inhalation Cancer Slope Factor (CSF_I) (mg/kg-day)$^{-1}$	Oral Reference Dose (RfDo) (mg/kg-day)	Dermal Reference Dose (RfDd) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Absorption Factor ABS (--)	Molecular Weight (g/mole)	Henry's Law Constant (atm-m^3/mole)	VOC? [2]	Soil RBSL[1] -- Construction Worker: Cancer (mg/kg)	Soil RBSL[1] -- Construction Worker: Noncancer (mg/kg)
Total Xylenes	NA	NA	NA	2.00E-01	2.00E-01	2.00E-01	0.1	1.1E+02	7.3E-03	Yes	--	2.6E+04
m/p-Xylenes	NA	NA	NA	2.00E-01	2.00E-01	2.00E-01	0.1	1.1E+02	7.6E-03	Yes	--	2.6E+04
o-Xylene	NA	NA	NA	2.00E-01	2.00E-01	2.00E-01	0.1	1.1E+02	5.2E-03	Yes	--	2.6E+04

Notes:
1. Risk-based screening levels (RBSL) calculated using the methodology presented by OEHHA, 2005, Human-Exposed-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil, January.
2. Chemicals identified as a volatile organic compound (VOC) if the molecular weight is less than 200 g/mole and the Henry's Law Constant is greater than 1×10^{-5} atm-m^3/mole. Volatile TPH identified on the basis of analytical methods for the TPH mixture in soil vapor. The inhalation pathway is not evaluated in the RBSL for VOCs in soil. A particulate emission factor (PEF) of 2.0×10^7 m^3/kg is used in the derivation of RBSLs for all non-volatile chemicals.
3. Inhalation pathway not incorporated into the development of soil RBSLs for VOCs. Volatilization of chemicals from the subsurface to ambient air evaluated using RBSLs developed for soil vapor (Table C-13).

Abbreviations:
- atm-m^3/mole = atmospheres - cubic meter per mole
- g/mole = grams per mole
- mg/kg = milligrams per kilogram
- mg/kg-day = milligrams per kilogram - day
- NA = not available
- NC = noncarcinogenic
- -- = not applicable

Equations:

$$RBSL_{soil-risk} = \frac{TR \times BW \times AT_{ca}}{ED \times EF \times \left[\left(\frac{IR_s \times CSF_o}{CF_{kg-mg}}\right) + \left(\frac{SAs \times SAF \times ABS \times CSF_o}{CF_{kg-mg}}\right) + \left(\frac{IHR_a \times CSF_i}{PEF}\right)\right]}$$

$$RBSL_{soil-haz} = \frac{THQ \times BW \times AT_{nc}}{ED \times EF \times \left[\left(\frac{1}{RfD_o} \times \frac{IR_s}{CF_{kg-mg}}\right) + \left(\frac{1}{RfD_o} \times \frac{SAs \times SAF \times ABS}{CF_{kg-mg}}\right) + \left(\frac{1}{RfD_i} \times \frac{IHR_a}{PEF}\right)\right]}$$

See Section 3.1.

TABLE C-9

HEALTH-BASED SCREENING LEVELS FOR LEAD IN SOIL

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Exposure Scenario	Screening Level[1] (mg/kg)
Outdoor Commercial/Industrial Worker	320
Construction Worker	940

Notes:

1. Health-based screening levels derived using either the U.S. EPA Adult Lead Model (U.S. EPA, 2005) (for commercial/industrial workers) or DTSC's Leadspread (1999) (for construction workers), as described in Section 3.2 and presented in Attachments B-1 and B-2.

Abbreviations:

mg/kg = milligrams per kilogram

TABLE C-10
EXPOSURE PARAMETERS USED IN DEVELOPING RISK-BASED SCREENING LEVELS FOR INDOOR COMMERCIAL/INDUSTRIAL WORKERS

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Exposure Parameter	Units	Value
GENERAL EXPOSURE PARAMETERS		
Exposure Frequency (EF)	days/year	250
Exposure Duration (ED)	years	25
Body Weight (BW)	kg	70
Averaging Time (AT)	days	25,550 (carcinogens) 9,125 (noncarcinogens)
PATHWAY-SPECIFIC PARAMETERS		
Inhalation of Vapors in Indoor Air		
Inhalation Rate (IHR_a)	m^3/day	14 (over an 8 hour workday)

<u>Abbreviations</u>:
kg = kilograms
m^3/day = cubic meters per day

TABLE C-11

RISK-BASED SCREENING LEVELS FOR SOIL VAPOR - INDOOR COMMERCIAL/INDUSTRIAL WORKER

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Chemical	Inhalation Toxicity Criteria		Soil Vapor RBSL -- Indoor Commercial/Industrial Worker					
	Cancer Slope Factor (CSF_i) (mg/kg-day)$^{-1}$	Reference Dose (RfD_i) (mg/kg-day)	Cancer			Noncancer		
			Indoor Air (µg/m^3)	alpha[2] (unitless)	Soil Vapor (µg/L)	Indoor Air (µg/m^3)	alpha[2] (unitless)	Soil Vapor (µg/L)
Volatile Aliphatic and Aromatic Hydrocarbons								
C5-C8 Aliphatics	NA	2.0E-01	--	5.3E-04	--	1.5E+03	5.3E-04	2.7E+03
C9-C18 Aliphatics	NA	8.6E-02	--	5.3E-04	--	6.3E+02	5.3E-04	1.2E+03
C9-C16 Aromatics	NA	1.4E-02	--	5.4E-04	--	1.0E+02	5.4E-04	1.9E+02
Volatile Organic Compounds (VOCs)								
Chloroform	1.9E-02	8.6E-02	1.1E+00	5.5E-04	2.0E+00	6.3E+02	5.5E-04	1.1E+03
1,2-Dichloroethane (EDC)	7.2E-02	6.9E-01	2.8E-01	5.5E-04	5.2E-01	5.0E+03	5.5E-04	9.1E+03
1,1-Dichloroethylene	NA	2.0E-02	--	5.0E-04	--	1.5E+02	5.0E-04	2.9E+02
cis-1,2-Dichloroethylene	NC	1.0E-02	NC	4.5E-04	NC	7.3E+01	4.5E-04	1.6E+02
Naphthalene	1.2E-01	2.6E-03	1.7E-01	3.9E-04	4.4E-01	1.9E+01	3.9E-04	4.9E+01
Tetrachloroethylene (PCE)	2.1E-02	1.0E-02	9.7E-01	4.4E-04	2.2E+00	7.3E+01	4.4E-04	1.7E+02
Toluene	NA	8.6E-02	--	4.9E-04	--	6.3E+02	4.9E-04	1.3E+03
1,1,1-Trichloroethane	NC	1.4E+00	NC	4.6E-04	NC	1.0E+04	4.6E-04	2.3E+04
Trichloroethylene (TCE)	7.0E-03	1.7E-01	2.9E+00	4.7E-04	6.3E+00	1.3E+03	4.7E-04	2.7E+03
1,2,4-Trimethylbenzene	NA	2.0E-03	--	3.9E-04	--	1.5E+01	3.9E-04	3.7E+01
1,3,5-Trimethylbenzene	NA	1.7E-03	--	3.9E-04	--	1.3E+01	3.9E-04	3.2E+01
m,p-Xylenes	NA	2.0E-01	--	4.6E-04	--	1.5E+03	4.6E-04	3.2E+03
o-Xylene	NA	2.0E-01	--	4.9E-04	--	1.5E+03	4.9E-04	3.0E+03

Notes:

1. Risk-based screening levels (RBSL) calculated using the methodology outlined by OEHHA, 2005, Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil, January.
2. Chemical-specific alphas calculated using the Johnson and Ettinger Model and default parameters for existing commercial/industrial buildings as outlined by OEHHA (2005). Johnson and Ettinger Model outputs are presented in Attachment C-1.

Abbreviations:

µg/L = micrograms per liter
µg/m^3 = micrograms per cubic meter
NA = not available
NC = noncarcinogenic
-- = not applicable

Equations:

$$C_{ia-risk} = \frac{TR \times BW \times ATca \times CF_{mg-ug}}{IHR_{ia} \times EF \times ED \times CSF_i}$$

$$C_{ia-haz} = \frac{THQ \times BW \times ATnc \times CF_{mg-ug}}{IHR_{ia} \times EF \times ED \times 1 / RfD_i}$$

$$RBSL_{soil\ vapor-ia} = \frac{C_{ia}}{\alpha \times CF_{m3-L}}$$

See Section 4.1.

TABLE C-12

RISK-BASED SCREENING LEVELS FOR SOIL VAPOR - OUTDOOR COMMERCIAL/INDUSTRIAL WORKER EXPOSURE TO AMBIENT AIR

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Chemical	Inhalation Toxicity Criteria									Soil Vapor RBSL[1] -- Outdoor Commercial/Industrial Worker							
										Cancer				Noncancer			
	Cancer Slope Factor (CSF_i) (mg/kg-day)$^{-1}$	Reference Dose (RfDi) (mg/kg-day)	Diffusivity in Air (Di) (cm^2/sec)	Diffusivity in Water (Dw) (cm^2/sec)	Henry's Law Constant (H) (atm-m^3/mole)	Dimensionless Henry's Law Constant (H') (unitless)	Organic Carbon Partition Coefficient (Koc) (L/kg)	Soil-Organic Partition Coefficient (Kd) (cm^3/g)	Effective Diffusivity (Da) (cm^2/sec)	Ambient Air Screening Level (µg/m^3)	Emission Rate (Ei) (µg/m^2-sec)	Total Solute Concentration (CT) (µg/cm^3)	Soil Vapor Screening Level (µg/L)	Ambient Air Screening Level (µg/m^3)	Emission Rate (Ei) (µg/m^2-sec)	Total Solute Concentration (CT) (µg/cm^3)	Soil Vapor Screening Level (µg/L)
Volatile Aliphatic and Aromatic Hydrocarbons																	
C5-C8 Aliphatics	NA	2.0E-01	1.0E-01	1.0E-05	8.0E-01	3.3E+01	4.0E+03	8.0E+00	2.2E-02	--	--	--	--	1.5E+03	8.6E+01	1.4E+03	2.0E+06
C9-C18 Aliphatics	NA	8.6E-02	1.0E-01	1.0E-05	1.9E+00	7.8E+01	2.5E+05	5.0E+02	1.5E-03	--	--	--	--	6.3E+02	3.7E+01	2.4E+03	2.2E+05
C9-C16 Aromatics	NA	1.4E-02	1.0E-01	1.0E-05	1.2E-02	4.9E-01	2.5E+03	5.0E+00	9.3E-04	--	--	--	--	1.0E+02	6.1E+00	5.0E+02	2.9E+04
Volatile Organic Compounds (VOCs)																	
Chloroform	1.9E-02	8.6E-02	1.0E-01	1.0E-05	3.7E-03	1.5E-01	4.0E+01	8.0E-02	1.1E-02	1.1E+00	6.3E-02	1.5E+00	9.8E+02	6.3E+02	3.7E+01	8.9E+02	5.7E+05
1,2-Dichloroethane (EDC)	7.2E-02	6.9E-01	1.0E-01	9.9E-06	9.8E-04	4.0E-02	1.7E+01	3.5E-02	5.4E-03	2.8E-01	1.7E-02	5.7E-01	1.8E+02	5.0E+03	3.0E+02	1.0E+04	3.2E+06
1,1-Dichloroethylene	NA	2.0E-02	9.0E-02	1.0E-05	2.6E-02	1.1E+00	5.9E+01	1.2E-01	2.6E-02	--	--	--	--	1.5E+02	8.6E+00	1.3E+02	2.4E+05
cis-1,2-Dichloroethylene	NC	1.0E-02	7.4E-02	1.1E-05	4.1E-03	1.7E-01	3.6E+01	7.1E-02	8.8E-03	NC	NC	NC	NC	7.3E+01	4.3E+00	1.1E+02	8.5E+04
Naphthalene	1.2E-01	2.6E-03	5.9E-02	7.5E-06	4.8E-04	2.0E-02	2.0E+03	4.0E+00	2.8E-05	1.7E-01	1.0E-02	4.7E+00	1.4E+01	1.9E+01	1.1E+00	5.2E+02	1.5E+03
Tetrachloroethylene (PCE)	2.1E-02	1.0E-02	7.2E-02	8.2E-06	1.8E-02	7.5E-01	1.6E+02	3.1E-01	1.1E-02	9.7E-01	5.7E-02	1.4E+00	1.3E+03	7.3E+01	4.3E+00	1.0E+02	9.6E+04
Toluene	NA	8.6E-02	8.7E-02	8.6E-06	6.6E-03	2.7E-01	1.8E+02	3.6E-01	5.1E-03	--	--	--	--	6.3E+02	3.7E+01	1.3E+03	4.7E+05
1,1,1-Trichloroethane	NC	1.4E+00	7.8E-02	8.8E-06	1.7E-02	7.0E-01	1.1E+02	2.2E-01	1.4E-02	NC	NC	NC	NC	1.0E+04	6.1E+02	1.3E+04	1.4E+07
Trichloroethylene (TCE)	7.0E-03	1.7E-01	7.9E-02	9.1E-06	1.0E-02	4.2E-01	1.7E+02	3.3E-01	7.2E-03	2.9E+00	1.7E-01	5.0E+00	2.9E+03	1.3E+03	7.4E+01	2.2E+03	1.2E+06
1,2,4-Trimethylbenzene	NA	2.0E-03	6.1E-02	7.9E-06	6.1E-03	2.5E-01	1.4E+03	2.7E+00	5.3E-04	--	--	--	--	1.5E+01	8.6E-01	9.3E+01	5.1E+03
1,3,5-Trimethylbenzene	NA	1.7E-03	6.0E-02	8.7E-06	5.9E-03	2.4E-01	1.4E+03	2.7E+00	5.0E-04	--	--	--	--	1.3E+01	7.4E-01	8.2E+01	4.3E+03
m,p-Xylenes	NA	2.0E-01	7.7E-02	8.4E-06	7.6E-03	3.1E-01	3.9E+02	7.8E-01	2.7E-03	--	--	--	--	1.5E+03	8.6E+01	4.1E+03	9.0E+05
o-Xylene	NA	2.0E-01	8.7E-02	1.0E-05	5.2E-03	2.1E-01	3.6E+02	7.3E-01	2.2E-03	--	--	--	--	1.5E+03	8.6E+01	4.5E+03	7.2E+05

Notes:
1. Risk-based screening levels (RBSL) calculated using the X/Q dispersion model and the VOC Emission Model presented in U.S. EPA, 1996, Soil Screening Guidance: Users Guide and Technical Background Document.

Abbreviations:
- atm-m^3/mole = atmospheres - cubic meter per mole
- cm^2/sec = square centimeters per second
- cm^3/g = cubic centimeters per gram
- L/kg = liters per kilogram
- µg/cm^3 = micrograms per cubic centimeter
- µg/L = micrograms per liter
- µg/m^2-sec = micrograms per square meter per second
- µg/m^3 = micrograms per cubic meter
- NA = not available
- NC = noncarcinogenic
- -- = not applicable

Equations:

$$C_{oa-risk} = \frac{TR \times BW \times ATca \times CF_{mg-ug}}{IHR_{ia} \times EF \times ED \times CSF_i}$$

$$C_{oa-haz} = \frac{THQ \times BW \times ATnc \times CF_{mg-ug}}{IHR_{ia} \times EF \times ED \times 1/RfD_i}$$

$$E_i = \frac{C_{oa}}{X/Q}$$

$$CT = \frac{Ei \times \sqrt{\pi \times Da \times T}}{2 \times Da \times CF_{m2-cm2}}$$

$$RBSL_{soil\,vapor-oa} = \frac{CT}{[(pb \times Kd/H') + Pw/H' + Pa] \times CF_{cm3-L}}$$

See Sections 4.1 and 4.2.

TABLE C-13

RISK-BASED SCREENING LEVELS FOR SOIL VAPOR -
CONSTRUCTION WORKER EXPOSURE TO AMBIENT AIR
Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Chemical	Inhalation Toxicity Criteria		Diffusivity in Air (Di) (cm²/sec)	Diffusivity in Water (Dw) (cm²/sec)	Henry's Law Constant (H) (atm-m³/mole)	Dimensionless Henry's Law Constant (H') (unitless)	Organic Carbon Partition Coefficient (Koc) (L/kg)	Soil-Organic Partition Coefficient (Kd) (cm³/g)	Effective Diffusivity (Da) (cm²/sec)	Soil Vapor RBSL[1] -- Construction Worker							
										Cancer				Noncancer			
	Cancer Slope Factor (CSF_i) (mg/kg-day)$^{-1}$	Reference Dose (RfDi) (mg/kg-day)								Ambient Air Screening Level (µg/m³)	Emission Rate (Ei) (µg/m²-sec)	Total Solute Concentration (CT) (µg/cm³)	Soil Vapor Screening Level (µg/L)	Ambient Air Screening Level (µg/m³)	Emission Rate (Ei) (µg/m²-sec)	Total Solute Concentration (CT) (µg/cm³)	Soil Vapor Screening Level (µg/L)
Volatile Aliphatic and Aromatic Hydrocarbons																	
C5-C8 Aliphatics	NA	2.0E-01	1.0E-01	1.0E-05	8.0E-01	3.3E+01	4.0E+03	8.0E+00	2.2E-02	--	--	--	--	1.0E+03	6.0E+01	2.0E+02	2.8E+05
C9-C18 Aliphatics	NA	8.6E-02	1.0E-01	1.0E-05	1.9E+00	7.8E+01	2.5E+05	5.0E+02	1.5E-03	--	--	--	--	4.4E+02	2.6E+01	3.4E+02	3.0E+04
C9-C16 Aromatics	NA	1.4E-02	1.0E-01	1.0E-05	1.2E-02	4.9E-01	2.5E+03	5.0E+00	9.3E-04	--	--	--	--	7.3E+01	4.3E+00	7.0E+01	4.0E+03
Volatile Organic Compounds (VOCs)																	
Chloroform	1.9E-02	8.6E-02	1.04E-01	1.00E-05	3.66E-03	1.50E-01	3.98E+01	7.96E-02	1.07E-02	1.88E+01	1.11E+00	5.33E+00	3.4E+03	4.4E+02	2.6E+01	1.2E+02	7.9E+04
1,2-Dichloroethane (EDC)	7.2E-02	6.9E-01	1.04E-01	9.90E-06	9.77E-04	4.00E-02	1.74E+01	3.48E-02	5.38E-03	4.97E+00	2.93E-01	1.99E+00	6.4E+02	3.5E+03	2.1E+02	1.4E+03	4.5E+05
1,1-Dichloroethylene	NA	2.0E-02	9.00E-02	1.04E-05	2.60E-02	1.07E+00	5.89E+01	1.18E-01	2.61E-02	--	--	--	--	1.0E+02	6.0E+00	1.9E+01	3.3E+04
cis-1,2-Dichloroethylene	NC	1.0E-02	7.36E-02	1.13E-05	4.07E-03	1.67E-01	3.55E+01	7.10E-02	8.77E-03	NC	NC	NC	NC	5.1E+01	3.0E+00	1.6E+01	1.2E+04
Naphthalene	1.2E-01	2.6E-03	5.90E-02	7.50E-06	4.82E-04	1.98E-02	2.00E+03	4.00E+00	2.80E-05	2.98E+00	1.76E-01	1.65E+01	4.9E+01	1.3E+01	7.7E-01	7.3E+01	2.1E+02
Tetrachloroethylene (PCE)	2.1E-02	1.0E-02	7.20E-02	8.20E-06	1.84E-02	7.53E-01	1.55E+02	3.10E-01	1.08E-02	1.70E+01	1.00E+00	4.81E+00	4.5E+03	5.1E+01	3.0E+00	1.4E+01	1.3E+04
Toluene	NA	8.6E-02	8.70E-02	8.60E-06	6.62E-03	2.72E-01	1.82E+02	3.64E-01	5.10E-03	--	--	--	--	4.4E+02	2.6E+01	1.8E+02	6.6E+04
1,1,1-Trichloroethane	NC	1.4E+00	7.80E-02	8.80E-06	1.72E-02	7.03E-01	1.10E+02	2.20E-01	1.37E-02	NC	NC	NC	NC	7.3E+03	4.3E+02	1.8E+03	2.0E+06
Trichloroethylene (TCE)	7.0E-03	1.7E-01	7.90E-02	9.10E-06	1.03E-02	4.21E-01	1.66E+02	3.32E-01	7.24E-03	5.11E+01	3.01E+00	1.76E+01	1.0E+04	8.8E+02	5.2E+01	3.0E+02	1.7E+05
1,2,4-Trimethylbenzene	NA	2.0E-03	6.06E-02	7.92E-06	6.14E-03	2.52E-01	1.35E+03	2.70E+00	5.32E-04	--	--	--	--	1.0E+01	6.0E-01	1.3E+01	7.1E+02
1,3,5-Trimethylbenzene	NA	1.7E-03	6.02E-02	8.67E-06	5.87E-03	2.41E-01	1.35E+03	2.70E+00	5.05E-04	--	--	--	--	8.8E+00	5.2E-01	1.1E+01	6.0E+02
m,p-Xylenes	NA	2.0E-01	7.69E-02	8.44E-06	7.64E-03	3.13E-01	3.89E+02	7.78E-01	2.68E-03	--	--	--	--	1.0E+03	6.0E+01	5.8E+02	1.3E+05
o-Xylene	NA	2.0E-01	8.70E-02	1.00E-05	5.18E-03	2.12E-01	3.63E+02	7.26E-01	2.24E-03	--	--	--	--	1.0E+03	6.0E+01	6.3E+02	1.0E+05

Notes:
1. Risk-based screening levels (RBSL) calculated using the X/Q dispersion model and the VOC Emission Model presented in U.S. EPA, 1996, Soil Screening Guidance: Users Guide and Technical Background Document.

Abbreviations:
- atm-m³/mole = atmospheres - cubic meter per mole
- cm²/sec = square centimeters per second
- cm³/g = cubic centimeters per gram
- L/kg = liters per kilogram
- µg/cm³ = micrograms per cubic centimeter
- µg/L = micrograms per liter
- µg/m²-sec = micrograms per square meter per second
- µg/m³ = micrograms per cubic meter
- NA = not available
- NC = noncarcinogenic
- -- = not applicable

Equations:

$$C_{oa-risk} = \frac{TR \times BW \times ATca \times CF_{mg-ug}}{IHR_{ia} \times EF \times ED \times CSF_i}$$

$$C_{oa-haz} = \frac{THQ \times BW \times ATnc \times CF_{mg-ug}}{IHR_{ia} \times EF \times ED \times 1/RfD_i}$$

$$E_i = \frac{C_{oa}}{X/Q}$$

$$CT = \frac{Ei \times \sqrt{\pi \times Da \times T}}{2 \times Da \times CF_{m2-cm2}}$$

$$RBSL_{soil\,vapor-oa} = \frac{CT}{[(pb \times Kd/H') + Pw/H' + Pa] \times CF_{cm3-L}}$$

See Sections 4.1 and 4.2.

TABLE C-14

RISK-BASED SCREENING LEVELS FOR TPH MIXTURES IN SOIL VAPOR

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Hydrocarbon Range	Soil Vapor RBSLs -- Noncancer: Indoor Commercial/ Industrial Worker (µg/L)[1]	Soil Vapor RBSLs -- Noncancer: Outdoor Commercial/ Industrial Worker (µg/L)[2]	Soil Vapor RBSLs -- Noncancer: Construction Worker (µg/L)[3]
c5-c8 Aliphatics	2.7E+03	2.0E+06	2.8E+05
c9-c18 Aliphatics	1.2E+03	2.2E+05	3.0E+04
c9-c16 Aromatics	1.9E+02	2.9E+04	4.0E+03

Chemical	Apportion Method[4]						Worst Case[6]		
	Normalized Percentages Estimated for Each Hydrocarbon Range[5]			Soil Vapor RBSLs -- Noncancer			Soil Vapor RBSLs -- Noncancer		
	C5-C8 Aliphatics	C9-C18 Aliphatics	C9-C16 Aromatics	Indoor Commercial/ Industrial Worker (µg/L)	Outdoor Commercial/ Industrial Worker (µg/L)	Construction Worker (µg/L)	Indoor Commercial/ Industrial Worker (µg/L)	Outdoor Commercial/ Industrial Worker (µg/L)	Construction Worker (µg/L)
TPH as Stoddard solvent	29%	57%	14%	**1.5E+03**	**6.9E+05**	**1.0E+05**	**6.8E+02**	**1.2E+05**	**1.7E+04**

Notes:

1. Soil vapor RBSLs calculated as discussed in Section 4.1 and presented in Table C-11.
2. Soil vapor RBSLs calculated as discussed in Section 4.2 and presented in Table C-12.
3. Soil vapor RBSLs calculated as discussed in Section 4.2 and presented in Table C-13.
4. Apportion method RBSLs calculated by summing the soil vapor RBSLs for c5-c8 aliphatics, c9-c18 aliphatics, and c9-c16 aromatics, weighted by their respective normalized percentages.
5. Normalized percentages estimated as discussed in Section 2.1.1 and presented in Table C-2.
6. Worst case RBSLs calculated assuming Stoddard solvent is composed of 50% aliphatic and 50% aromatic hydrocarbons, and using the most health-protective RBSLs of the volatile aliphatic and aromatic hydrocarbon groups within the mixture (c9-c18 aliphatics and c9-c16 aromatics).

Abbreviations:

µg/L = micrograms per liter
RBSL = risk-based screening level
TPH = total petroleum hydrocarbons

TABLE C-15

RISK-BASED SCREENING LEVELS FOR TPH MIXTURES IN GROUNDWATER

Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Hydrocarbon Range	Groundwater RBSLs -- Noncancer Indoor Commercial/ Industrial Worker (μg/L)[1]
c5-c8 Aliphatics	9.2E+02
c9-c18 Aliphatics	1.7E+02
c9-c16 Aromatics	4.7E+03

	Apportion Method[2]				Worst Case[4]
	Normalized Percentages Estimated for Each Hydrocarbon Range[3]			Groundwater RBSLs -- Noncancer	Groundwater RBSLs -- Noncancer
Chemical	C5-C8 Aliphatics	C9-C18 Aliphatics	C9-C16 Aromatics	Indoor Commercial/ Industrial Worker (μg/L)	Indoor Commercial/ Industrial Worker (μg/L)
TPH as gasoline (c6-c12)	33%	44%	24%	**1.5E+03**	**6.8E+02**

Notes:

1. Groundwater RBSLs calculated as discussed in Section 5.0 and presented in Attachment D-2.
2. Apportion method RBSL calculated by summing the groundwater RBSLs for c5-c8 aliphatics, c9-c18 aliphatics, and c9-c16 aromatics, weighted by their respective normalized percentages.
3. Normalized percentages estimated as discussed in Section 2.1.1 and presented in Table C-2.
4. Worst case RBSL calculated assuming Stoddard solvent is composed of 50% aliphatic and 50% aromatic hydrocarbons, and using the most health-protective RBSLs of the volatile aliphatic and aromatic hydrocarbon groups within the mixture (c9-c18 aliphatics and c9-c16 aromatics).

Abbreviations:
μg/L = micrograms per liter
RBSL = risk-based screening level

ATTACHMENT A-1

ADDITIONAL EQUATIONS USED IN SOIL VAPOR SCREENING LEVEL CALCULATIONS

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Estimation of Chemical Constants **:** (U.S. EPA, 1996)

$$H' = H / RT \tag{1}$$

H' = Dimensionless Henry's Law Constant
H = Henry's Law Constant (atm-m^3/mole)
R = Universal gas constant (atm-m^3/mole-K)
T = Temperature (K)

$$Kd = Koc \times foc \tag{2}$$

Kd = Soil-organic partition coefficient (cm^3/g)
Koc = Organic carbon partition coefficient (L/kg)
foc = Fraction organic-carbon (unitless)

Supporting Equations **:** (U.S. EPA, 1996)

$$X/Q = \frac{CF_{kg\text{-}mg}}{Q/C \times CF_{g\text{-}mg}} \tag{3}$$

X/Q = Air dispersion factor (mg/m^3 per mg/m^2-sec)
Q/C = Inverse of dispersion factor (g/m^2-sec per kg/m^3)
$CF_{g\text{-}mg}$ = Conversion Factor from g to mg (mg/g)
$CF_{kg\text{-}mg}$ = Conversion Factor from kg to mg (mg/kg)

$$Q/C = A \times \exp[(\ln Ac - B)^2 \div C] \tag{4}$$

Q/C = Inverse of dispersion factor (g/m^2-sec per kg/m^3)
Ac = Area of site (acres)
A = A Constant (Location - Los Angeles, CA)
B = B Constant (Location - Los Angeles, CA)
C = C Constant (Location - Los Angeles, CA)

ATTACHMENT A-1

ADDITIONAL EQUATIONS USED IN SOIL VAPOR SCREENING LEVEL CALCULATIONS

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Supporting Equations (continued): (U.S. EPA, 1996)

$$Da = \frac{[(Pa^{10/3} \times Di \times H' + Pw^{10/3} \times Dw) / Pt^2]}{pb \times Kd + Pw + Pa \times H'} \quad (5)$$

Da = Effective Diffusivity (cm^2/sec)
Pa = Air-filled soil porosity (unitless)
Di = Diffusivity in air (cm^2/sec)
H' = Dimensionless Henry's Law Constant
Pw = Water-filled soil porosity (unitless)
Dw = Diffusivity in water (cm^2/sec)
Pt = Total porosity (unitless)
pb = Soil bulk density (g/cm^3)
Kd = Soil-Organic partition coefficient (cm^3/g)

Abbreviations:
atm = atmospheres
cm^2 = square centimeters
cm^3 = cubic centimeters
g = grams
K = kelvin
kg = kilograms
L = liters
m^2 = square meters
m^3 = cubic meters
mg = milligrams
sec = seconds

ATTACHMENT A-2

RISK ASSESSMENT ASSUMPTIONS

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Parameter	Symbol	Value	Units	Source
Exposure Assumptions				
Target Risk	TR	1.0E-06	unitless	OEHHA, 2005a
Target Hazard Quotient	THQ	1.0E+00	unitless	OEHHA, 2005a
Duration - Commercial/Industrial	T_{ind}	7.9E+08	sec	Calculated
Duration - Construction	T_{cw}	3.2E+07	sec	Calculated
Site Assumptions				
Area of Source	Area	4576	m^2	Site-specific
Area of Source	Area_acres	1.13	acre	Site-specific
A Constant	A	11.91	unitless	Los Angeles
B Constant	B	18.44	unitless	Los Angeles
C Constant	C	209.78	unitless	Los Angeles
Air Dispersion Factor	X/Q	16.96	mg/m^3 per mg/m^2-sec	Calculated
Inverse of Dispersion Factor	Q/C	58.95	g/m^2-sec per kg/m^3	Calculated
Particulate Emission Factor				
Construction Worker	PEFcw	1.00E+06	m^3/kg	DTSC, 2005
Commercial/Industrial Worker	PEFow	1.32E+09	m^3/kg	DTSC, 2005
Temperature	T	295	Kelvin	Default
Soil Constants				
Fraction Organic Carbon	foc	0.002	unitless	Default
Air Filled Soil Porosity	Pa	0.321	unitless	Default for sandy soil type
Water Filled Soil Porosity	Pw	0.054	unitless	Default for sandy soil type
Total Porosity	Pt	0.375	unitless	Default for sandy soil type
Soil Bulk Density	rb	1.66	g/cm^3	Default for sandy soil type
Conversion Factors				
Conversion Factor from cm^3 to L	$CF_{cm3\text{-}L}$	1E-03	L/cm^3	Constant
Conversion Factor from m^3 to L	$CF_{m3\text{-}L}$	1E+03	L/m^3	Constant
Conversion Factor from g to kg	$CF_{g\text{-}kg}$	1E-03	kg/g	Constant
Conversion Factor from g to mg	$CF_{g\text{-}mg}$	1E+03	mg/g	Constant
Conversion Factor from kg to mg	$CF_{kg\text{-}mg}$	1E+06	mg/kg	Constant
Conversion Factor from m^2 to cm^2	$CF_{m2\text{-}cm2}$	1E+04	cm^2/m^2	Constant
Conversion Factor from mg to g	$CF_{mg\text{-}g}$	1E-06	g/mg	Constant

Abbreviations:
- cm^2 = square centimeters
- cm^3 = cubic centimeters
- g = grams
- kg = kilograms
- L = liters
- m^2 = square meters
- m^3 = cubic meters
- mg = milligrams
- sec = seconds

ATTACHMENT B-1

REVISED CALIFORNIA HUMAN HEALTH SCREENING LEVEL FOR LEAD
DEVELOPED USING U.S. EPA's ADULT LEAD MODEL (ALM) (U.S. EPA, 2005)
Outdoor Commercial/Industrial Worker

U.S. EPA Version date 05/19/05

Exposure Variable	Description of Exposure Variable	Units	Region OR Ethnic GSDi and PbBo Data from NHANES III Analysis							
			All/All	All/White	All/Black	All/Mexican	Northeast/All	Midwest/All	South/All	West/All
$PbB_{fetal, 0.90}$	90th percentile PbB in fetus	ug/dL	1	10	10	10	10	10	10	10
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
GSD_i	Geometric standard deviation PbB[a]	--	1.8	2.1	2.2	2.3	2.0	2.2	2.1	2.1
PbB_0	Baseline PbB[a]	ug/dL	0.0	1.5	1.8	1.7	2.0	1.5	1.4	1.4
IR_S	Soil ingestion rate (including soil-derived indoor dus	g/day	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)[a]	days/yr	250	219	219	219	219	219	219	219
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365	365	365	365	365	365	365	365
PRG		**ppm**	**318**	1,288	938	794	1,092	1,079	1,366	1,287

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same PRG.

Notes:
a = Default U.S. EPA ALM values replaced by values consistent with OEHHA recommendations (2009).
g = grams
µg/dL = micrograms per deciliter
y = year

ATTACHMENT B-2

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
Construction Worker

USER'S GUIDE to version 7

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.028
Lead in Soil/Dust (ug/g)	940
Lead in Water (ug/l)	15
% Home-grown Produce	7%
Respirable Dust (ug/m^3)	1.5

OUTPUT	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	6.5	11.9	14.0	17.1	19.4	391	614
BLOOD Pb, CHILD	13.4	24.4	28.9	35.2	40.0	146	247
BLOOD Pb, PICA CHILD	20.0	36.5	43.2	52.5	59.8	94	159
BLOOD Pb, OCCUPATIONAL	3.4	6.1	7.2	8.8	10.0	937	1474

EXPOSURE PARAMETERS	units	adults	children
Days per week	days/wk	7	
Days per week, occupational		5	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	5700	2900
Skin area occupational[a]	cm^2	5700	
Soil adherence[a]	ug/cm^2	800	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001	
Soil ingestion[b]	mg/day	165	100
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	20	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.08	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produce	ug/kg	423.0	

PATHWAYS

ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	4.4E-4	0.41	6%	3.1E-4	0.29	9%
Soil Ingestion	2.9E-3	2.73	42%	2.1E-3	1.95	58%
Inhalation, bkgrnd		0.05	1%		0.03	1%
Inhalation	2.5E-6	0.00	0%	1.8E-6	0.00	0%
Water Ingestion		0.84	13%		0.84	25%
Food Ingestion, bkgrnd		0.22	3%		0.23	7%
Food Ingestion	2.4E-3	2.25	35%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	0.05	0%		0.05	0%
Soil Ingestion	7.0E-3	6.62	49%	1.4E-2	13.24	66%
Inhalation	2.0E-6	0.00	0%		0.00	0%
Inhalation, bkgrnd		0.04	0%		0.04	0%
Water Ingestion		0.96	7%		0.96	5%
Food Ingestion, bkgrnd		0.50	4%		0.50	3%
Food Ingestion	5.5E-3	5.21	39%		5.21	26%

Notes:
a Default Lead Spread value replaced by value used in the derivation of other risk-based screening levels (see Table C-6).
b Default Lead Spread value replaced by 50 percent of the soil ingestion rate used in the derivation of other risk-based screening levels.

ATTACHMENT C-1

SOIL VAPOR ATTENTUATION FACTORS FOR VAPOR INTRUSION - INDOOR COMMERCIAL/INDUSTRIAL WORKER

Data Entry Sheet

SL-ADV
Version 3.0; 02/03

Geomatrix Version, 1.0.1
modified by MJC, Jan 2004
includes Cal-EPA CSFs

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER U.S. EPA or Cal-EPA: Cal-EPA

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (mg/kg)	Chemical
67663		Chloroform
107062		1,2-Dichloroethane
75354		1,1-Dichloroethylene
156592		cis-1,2-Dichloroethylene
91203		Naphthalene
127184		Tetrachloroethylene
108883		Toluene
71556		1,1,1-Trichloroethane
79016		Trichloroethylene
95636		1,2,4-Trimethylbenzene
108678		1,3,5-Trimethylbenzene
106423		p-Xylene
95476		o-Xylene
9999992		C5-C8 Aliphatics
9999994		C9-C18 Aliphatics
9999996		C9-C16 Aromatics

MORE ê

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G38) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
22	9	49	0	9	10	30	S		

MORE ê

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, r_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, q_w^A (cm³/cm³)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, r_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, q_w^B (cm³/cm³)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, r_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, q_w^C (cm³/cm³)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.66	0.375	0.054	0.002	S	1.66	0.375	0.054	0.002	SIC	1.60	0.30	0.15	0.002

MORE ê

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, DP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
9	40	1000	1000	244	0.1	1	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

ATTACHMENT C-1

SOIL VAPOR ATTENTUATION FACTORS FOR VAPOR INTRUSION - INDOOR COMMERCIAL/INDUSTRIAL WORKER

Chemical Properties Sheet

	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henrys law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henrys law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $DH_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(mg/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature (S,L,G)
Chloroform	1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	3.98E+01	7.92E+03	5.3E-06	3.0E-01	L
1,2-Dichloroethane	1.04E-01	9.90E-06	9.77E-04	25	7,643	356.65	561.00	1.74E+01	8.52E+03	2.2E-05	0.0E+00	L
1,1-Dichloroethylene	9.00E-02	1.04E-05	2.60E-02	25	6,247	304.75	576.05	5.89E+01	2.25E+03	0.0E+00	7.0E-02	L
cis-1,2-Dichloroethylene	7.36E-02	1.13E-05	4.07E-03	25	7,192	333.65	544.00	3.55E+01	3.50E+03	0.0E+00	3.5E-02	L
Naphthalene	5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	2.00E+03	3.10E+01	0.0E+00	9.0E-03	S
Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	5.9E-06	3.5E-02	L
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	1.82E+02	5.26E+02	0.0E+00	3.0E-01	L
1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	1.10E+02	1.33E+03	0.0E+00	2.2E+00	L
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01	L
1,2,4-Trimethylbenzene	6.06E-02	7.92E-06	6.14E-03	25	9,369	442.30	649.17	1.35E+03	5.70E+01	0.0E+00	6.0E-03	L
1,3,5-Trimethylbenzene	6.02E-02	8.67E-06	5.87E-03	25	9,321	437.89	637.25	1.35E+03	2.00E+00	0.0E+00	6.0E-03	L
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	3.89E+02	1.85E+02	0.0E+00	7.0E-01	L
o-Xylene	8.70E-02	1.00E-05	5.18E-03	25	8,661	417.60	630.30	3.63E+02	1.78E+02	0.0E+00	7.0E-01	L
C5-C8 Aliphatics	1.00E-01	1.00E-05	8.00E-01	25	7,000	369.00	508.00	3.98E+03	5.40E+00	0.0E+00	7.0E-01	0.0E+00
C9-C18 Aliphatics	1.00E-01	1.00E-05	1.90E+00	25	7,000	473.00	568.90	2.51E+05	3.40E-02	0.0E+00	3.0E-01	0.0E+00
C9-C16 Aromatics	1.00E-01	1.00E-05	1.20E-02	25	9,321	473.00	637.00	2.51E+03	2.50E+01	0.0E+00	5.0E-02	0.0E+00

ATTACHMENT C-1

SOIL VAPOR ATTENTUATION FACTORS FOR VAPOR INTRUSION - INDOOR COMMERCIAL/INDUSTRIAL WORKER

Intermediate Calculations Sheet

	Exposure duration, t (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, q_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, q_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, q_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (mg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
Chloroform	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
1,2-Dichloroethane	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
1,1-Dichloroethylene	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
cis-1,2-Dichloroethylene	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
Naphthalene	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
Tetrachloroethylene	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
Toluene	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
1,1,1-Trichloroethane	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
Trichloroethylene	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
1,2,4-Trimethylbenzene	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
1,3,5-Trimethylbenzene	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
p-Xylene	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
o-Xylene	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
C5-C8 Aliphatics	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
C9-C18 Aliphatics	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04
C9-C16 Aromatics	7.88E+08	40	0.321	0.321	0.150	0.003	1.01E-07	0.998	1.01E-07	4,000	0.00E+00	6.78E+04

	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, h (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $DH_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, m_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
Chloroform	1.00E+06	4.00E-04	9	7,429	3.22E-03	1.33E-01	1.79E-04	1.68E-02	1.68E-02	2.09E-03	2.67E-03	40	9
1,2-Dichloroethane	1.00E+06	4.00E-04	9	8,390	8.46E-04	3.49E-02	1.79E-04	1.68E-02	1.68E-02	2.09E-03	2.68E-03	40	9
1,1-Dichloroethylene	1.00E+06	4.00E-04	9	6,313	2.34E-02	9.65E-01	1.79E-04	1.45E-02	1.45E-02	1.80E-03	2.31E-03	40	9
cis-1,2-Dichloroethylene	1.00E+06	4.00E-04	9	7,612	3.57E-03	1.47E-01	1.79E-04	1.19E-02	1.19E-02	1.48E-03	1.89E-03	40	9
Naphthalene	1.00E+06	4.00E-04	9	12,789	3.87E-04	1.60E-02	1.79E-04	9.54E-03	9.54E-03	1.19E-03	1.53E-03	40	9
Tetrachloroethylene	1.00E+06	4.00E-04	9	9,431	1.56E-02	6.45E-01	1.79E-04	1.16E-02	1.16E-02	1.44E-03	1.85E-03	40	9
Toluene	1.00E+06	4.00E-04	9	9,023	5.67E-03	2.34E-01	1.79E-04	1.41E-02	1.41E-02	1.75E-03	2.23E-03	40	9
1,1,1-Trichloroethane	1.00E+06	4.00E-04	9	7,754	1.50E-02	6.20E-01	1.79E-04	1.26E-02	1.26E-02	1.56E-03	2.00E-03	40	9
Trichloroethylene	1.00E+06	4.00E-04	9	8,407	8.89E-03	3.67E-01	1.79E-04	1.28E-02	1.28E-02	1.58E-03	2.03E-03	40	9
1,2,4-Trimethylbenzene	1.00E+06	4.00E-04	9	11,541	5.04E-03	2.08E-01	1.79E-04	9.80E-03	9.80E-03	1.22E-03	1.56E-03	40	9
1,3,5-Trimethylbenzene	1.00E+06	4.00E-04	9	11,521	4.82E-03	1.99E-01	1.79E-04	9.73E-03	9.73E-03	1.21E-03	1.55E-03	40	9
p-Xylene	1.00E+06	4.00E-04	9	10,107	6.42E-03	2.65E-01	1.79E-04	1.24E-02	1.24E-02	1.54E-03	1.98E-03	40	9
o-Xylene	1.00E+06	4.00E-04	9	10,268	4.34E-03	1.79E-01	1.79E-04	1.41E-02	1.41E-02	1.75E-03	2.23E-03	40	9
C5-C8 Aliphatics	1.00E+06	4.00E-04	9	8,336	6.93E-01	2.86E+01	1.79E-04	1.62E-02	1.62E-02	2.01E-03	2.57E-03	40	9
C9-C18 Aliphatics	1.00E+06	4.00E-04	9	10,761	1.58E+00	6.52E+01	1.79E-04	1.62E-02	1.62E-02	2.01E-03	2.57E-03	40	9
C9-C16 Aromatics	1.00E+06	4.00E-04	9	12,596	9.67E-03	3.99E-01	1.79E-04	1.62E-02	1.62E-02	2.01E-03	2.57E-03	40	9

	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (mg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, a (unitless)	Infinite source bldg. conc., $C_{building}$ (mg/m^3)	Finite source b term (unitless)	Finite source y term $(sec)^{-1}$	Time for source depletion, t_D (sec)	Exposure duration > time for source depletion (YES/NO)
Chloroform	7.96E-02	0.00E+00	0.10	8.33E+01	1.68E-02	4.00E+02	2.72E+48	5.47E-04	0.00E+00	NA	NA	NA	NA
1,2-Dichloroethane	3.48E-02	0.00E+00	0.10	8.33E+01	1.68E-02	4.00E+02	2.72E+48	5.48E-04	0.00E+00	NA	NA	NA	NA
1,1-Dichloroethylene	1.18E-01	0.00E+00	0.10	8.33E+01	1.45E-02	4.00E+02	9.30E+55	5.03E-04	0.00E+00	NA	NA	NA	NA
cis-1,2-Dichloroethylene	7.10E-02	0.00E+00	0.10	8.33E+01	1.19E-02	4.00E+02	2.75E+68	4.45E-04	0.00E+00	NA	NA	NA	NA
Naphthalene	4.00E+00	0.00E+00	0.10	8.33E+01	9.54E-03	4.00E+02	2.37E+85	3.86E-04	0.00E+00	NA	NA	NA	NA
Tetrachloroethylene	3.10E-01	0.00E+00	0.10	8.33E+01	1.16E-02	4.00E+02	9.13E+69	4.39E-04	0.00E+00	NA	NA	NA	NA
Toluene	3.64E-01	0.00E+00	0.10	8.33E+01	1.41E-02	4.00E+02	7.91E+57	4.93E-04	0.00E+00	NA	NA	NA	NA
1,1,1-Trichloroethane	2.20E-01	0.00E+00	0.10	8.33E+01	1.26E-02	4.00E+02	3.79E+64	4.61E-04	0.00E+00	NA	NA	NA	NA
Trichloroethylene	3.32E-01	0.00E+00	0.10	8.33E+01	1.28E-02	4.00E+02	5.78E+63	4.65E-04	0.00E+00	NA	NA	NA	NA
1,2,4-Trimethylbenzene	2.70E+00	0.00E+00	0.10	8.33E+01	9.80E-03	4.00E+02	1.32E+83	3.91E-04	0.00E+00	NA	NA	NA	NA
1,3,5-Trimethylbenzene	2.70E+00	0.00E+00	0.10	8.33E+01	9.73E-03	4.00E+02	4.72E+83	3.90E-04	0.00E+00	NA	NA	NA	NA
p-Xylene	7.78E-01	0.00E+00	0.10	8.33E+01	1.24E-02	4.00E+02	3.18E+65	4.57E-04	0.00E+00	NA	NA	NA	NA
o-Xylene	7.26E-01	0.00E+00	0.10	8.33E+01	1.41E-02	4.00E+02	7.91E+57	4.93E-04	0.00E+00	NA	NA	NA	NA
C5-C8 Aliphatics	7.96E+00	0.00E+00	0.10	8.33E+01	1.62E-02	4.00E+02	2.35E+50	5.35E-04	0.00E+00	NA	NA	NA	NA
C9-C18 Aliphatics	5.02E+02	0.00E+00	0.10	8.33E+01	1.62E-02	4.00E+02	2.35E+50	5.35E-04	0.00E+00	NA	NA	NA	NA
C9-C16 Aromatics	5.02E+00	0.00E+00	0.10	8.33E+01	1.62E-02	4.00E+02	2.35E+50	5.35E-04	0.00E+00	NA	NA	NA	NA

ATTACHMENT D-1

SUMMARY OF INPUT PARAMETERS - RISK-BASED SCREENING LEVELS FOR VAPOR INTRUSION FROM GROUNDWATER

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Parameter	Value	Rationale
Groundwater Parameters		
Depth Below Grade to Water Table L_{WT} (cm)	4572	Site-specific: Depth to groundwater (150 feet) based on the logs of borings 125 and 126.
Soil Parameters		
Average Soil/Groundwater Temperature, T_s (°C)	22	Default: Highest California average annual soil temperature as provided by USEPA, 2003 and OEHHA, 2005.
Stratum A Soil Properties		
SCS Soil Type (unitless)	Sand	Site-specific: Soil types provided in the logs of borings 125 and 126 included sands and silts from the surface to approximately 54 feet bgs, where clays were encountered. To be conservative, assumed this combined stratum, from 0 to 54 feet bgs, was sand.
Thickness, h_A (cm)	1646	Site-specific: Depth of initial sand/silt stratum based on the logs of borings 125 and 126.
Soil Dry Bulk Density, ρ_b^A (g/cm^3)	1.66	Default: Default value for sand SCS soil type provided by USEPA, 2003 and OEHHA, 2005.
Soil Total Porosity, n^A (unitless)	0.375	Default: Default value for sand SCS soil type provided by USEPA, 2003 and OEHHA, 2005.
Soil Water-Filled Porosity, θ_w^A (cm^3/cm^3)	0.054	Default: Default value for sand SCS soil type provided by USEPA, 2003 and OEHHA, 2005.
Stratum B Soil Properties		
SCS Soil Type (unitless)	Clay	Site-specific: Clay soil type provided in the logs of borings 125 and 126 at approximately 53 or 54 feet bgs. In boring 125, clays were encountered from 54 to 64 feet bgs, and also from 85 to 89 feet bgs (for a combined 14 feet of clay), with sands and silts in between. In boring 126, clays were encountered from 53 to 63 feet bgs, 104 to 111 feet bgs, and 121 to 125 feet bgs (for a combined 21 feet of clay), with sands and silts in between. To be conservative, Stratum B was assumed to be only 14 feet of clay (based on boring 125), extending from 54 to 68 feet bgs.
Thickness, h_B (cm)	426.72	Site-specific: 14 feet of clay (combined) based on boring 125
Soil Dry Bulk Density, ρ_b^B (g/cm^3)	1.43	Default: Default value for clay SCS soil type provided by USEPA, 2003 and OEHHA, 2005.
Soil Total Porosity, n^B (unitless)	0.459	Default: Default value for clay SCS soil type provided by USEPA, 2003 and OEHHA, 2005.
Soil Water-Filled Porosity, θ_w^B (cm^3/cm^3)	0.215	Default: Default value for clay SCS soil type provided by USEPA, 2003 and OEHHA, 2005.
Stratum C Soil Properties		
SCS Soil Type (unitless)	Sand	Site-specific: Soil types provided in the logs of borings 125 and 126 below clay to groundwater included sands and silts. To be conservative, assumed the combined stratum was sand.
Thickness, h_A (cm)	2499.28	Site-specific: Assumed the lower stratum extended from 68 feet to groundwater (82 feet).
Soil Dry Bulk Density, ρ_b^A (g/cm^3)	1.66	Default: Default value for sand SCS soil type provided by USEPA, 2003 and OEHHA, 2005.
Soil Total Porosity, n^A (unitless)	0.375	Default: Default value for sand SCS soil type provided by USEPA, 2003 and OEHHA, 2005.
Soil Water-Filled Porosity, θ_w^A (cm^3/cm^3)	0.054	Default: Default value for sand SCS soil type provided by USEPA, 2003 and OEHHA, 2005.

ATTACHMENT D-1

SUMMARY OF INPUT PARAMETERS - RISK-BASED SCREENING LEVELS FOR VAPOR INTRUSION FROM GROUNDWATER

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Parameter	Value	Rationale
Building Parameters		
Enclosed Space Floor Thickness, L_{crack} (cm)	9	Default: Default value provided by USEPA, 2002, DTSC, 2005, and OEHHA, 2005.
Soil-Building Pressure Differential ΔP (g/cm-s^2)	40	Default: Default value provided by USEPA, 2002, DTSC, 2005, and OEHHA, 2005.
Enclosed Space Floor Length, Width, Height L_B, W_B, H_B (cm)	Length: 1000 Width: 1000 Height: 244	Default: Default values provided by USEPA, 2002, DTSC, 2005, and OEHHA, 2005.
Floor-Wall Seam Crack Width, w (cm)	0.1	Default: Default value provided by USEPA, 2002 and OEHHA, 2005.
Indoor Air Exchange Rate, ER (1/hr)	1	Default: Default value for commercial/industrial buildings provided by DTSC, 2005 and OEHHA, 2005.
Average Vapor Flow Rate into Building Q_{soil} (L/m)	5	Default: Default value provided by USEPA, 2002 and OEHHA, 2005.
Crack-to-Total Area Ratio η (unitless)	0.005	Default: DTSC, 2005.
Exposure Parameters		
Averaging Time for Carcinogens, AT_c (yrs)	70	Default: Default value provided by USEPA, 1991 and OEHHA, 2005 for commercial/industrial workers.
Averaging Time for Noncarcinogens, AT_{nc} (yrs)	25	Default: Default value provided by USEPA, 1991 and OEHHA, 2005 for commercial/industrial workers.
Exposure Duration, ED (yrs)	25	Default: Default value provided by USEPA, 1991 and OEHHA, 2005 for commercial/industrial workers.
Exposure Frequency, EF (days/yr)	250	Default: Default value provided by USEPA, 1991 and OEHHA, 2005 for commercial/industrial workers.

References:
Department of Toxic Substances Control (DTSC), 2005, Guidance for the Evaluation and Migration of Subsurface Vapor Intrusion to Indoor Air, Interim Final, California. Environmental Protection Agency, February 7.
Office of Environmental Health Hazard Assessment (OEHHA), 2005, Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil, California Environmental Protection Agency, January.
U.S. Environmental Protection Agency (U.S. EPA), 1991, Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors, Office of Emergency and Remedial Response, Washington, D.C.
U.S. EPA, 2002, "Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)," Draft Federal Register, November 29.
U.S. EPA, 2003, "Draft User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings." Office of Emergency and Remedial Response. March 14.

ATTACHMENT D-2

RISK-BASED SCREENING LEVELS FOR VAPOR INTRUSION FROM GROUNDWATER - INDOOR COMMERCIAL/INDUSTRIAL WORKER

Data Entry Sheet

GW-ADV
Version 3.1; 02/04

Reset to Defaults

Geomatrix Consultants, Inc.
modified by CAK; 11/05
Mult. Chemical; version 3.1.2

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER U.S. EPA or Cal-EPA: Cal-EPA

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical	
71432	2.80E+00	Benzene	
67663	1.05E+02	Chloroform	
75354	1.20E+00	1,1-Dichloroethylene	
107062	4.10E+02	1,2-Dichloroethane	
75092	1.00E+01	Methylene chloride	
100414	8.50E-01	Ethylbenzene	
127184	4.60E+00	Tetrachloroethylene	
108883	2.90E+00	Toluene	
79016	4.20E+02	Trichloroethylene	
106423	3.90E+00	p-Xylene	for m,p-xylenes
95476	2.00E+00	o-Xylene	
9999992	1.00E+00	C5-C8 Aliphatics	
9999994	1.00E+00	C9-C18 Aliphatics	
9999996	1.00E+00	C9-C16 Aromatics	

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
22	9	4572	1646	426.72	2499.28	C	S	S		
		150	54	14	82					

Totals must add up to value of L_{WT} (cell G28)

ATTACHMENT D-2

RISK-BASED SCREENING LEVELS FOR VAPOR INTRUSION FROM GROUNDWATER - INDOOR COMMERCIAL/INDUSTRIAL WORKER

Data Entry Sheet

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	CL	1.43	0.459	0.215	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
9	40	1000	1000	244	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

ATTACHMENT D-2

RISK-BASED SCREENING LEVELS FOR VAPOR INTRUSION FROM GROUNDWATER - INDOOR COMMERCIAL/INDUSTRIAL WORKER

Chemical Properties Sheet

	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
Benzene	8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	5.89E+01	1.79E+03	2.9E-05	6.0E-02
Chloroform	1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	3.98E+01	7.92E+03	5.3E-06	3.0E-01
1,1-Dichloroethylene	9.00E-02	1.04E-05	2.60E-02	25	6,247	304.75	576.05	5.89E+01	2.25E+03	0.0E+00	7.0E-02
1,2-Dichloroethane	1.04E-01	9.90E-06	9.77E-04	25	7,643	356.65	561.00	1.74E+01	8.52E+03	2.1E-05	0.0E+00
Methylene chloride	1.01E-01	1.17E-05	2.18E-03	25	6,706	313.00	510.00	1.17E+01	1.30E+04	1.0E-06	4.0E-01
Ethylbenzene	7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	3.63E+02	1.69E+02	2.5E-06	2.0E+00
Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	5.9E-06	3.5E-02
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	1.82E+02	5.26E+02	0.0E+00	3.0E-01
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	3.89E+02	1.85E+02	0.0E+00	7.0E-01
o-Xylene	8.70E-02	1.00E-05	5.18E-03	25	8,661	417.60	630.30	3.63E+02	1.78E+02	0.0E+00	7.0E-01
C5-C8 Aliphatics	1.00E-01	1.00E-05	8.00E-01	25	7,000	369.00	508.00	3.98E+03	5.40E+00	0.0E+00	7.0E-01
C9-C18 Aliphatics	1.00E-01	1.00E-05	1.90E+00	25	7,000	473.00	568.90	2.51E+05	3.40E-02	0.0E+00	3.0E-01
C9-C16 Aromatics	1.00E-01	1.00E-05	1.20E-02	25	9,321	473.00	637.00	2.51E+03	2.50E+01	0.0E+00	5.0E-02

APPENDIX D

Site-Specific Modeling and Development of Screening Levels for the Protection of Groundwater

Appendix D

Site-Specific Modeling and Development of Screening Levels for the Protection of Groundwater

1. CALCULATIONS OF SITE-SPECIFIC SOIL SCREENING LEVELS FOR VOLATILE ORGANIC COMPOUND (VOC) CHEMICALS OF POTENTIAL CONCERN (COPCs) FOR PROTECTION OF GROUNDWATER

The site-specific soil screening levels at various depths for the VOC COPCs listed in Section 4.3 of the Feasibility Study (FS) were estimated following the procedures based on the Attenuation Factor (AF) Method developed by the California Regional Water Quality Control Board (RWQCB), Los Angeles Region in their guidance document "Interim Site Assessment & Cleanup Guidebook." The calculations were implemented in Mathcad® (Parametric Technology Corporation, 2007)[1] worksheets. Mathcad® is a general-purpose mathematical analysis software that is commercially available.

When available, the maximum attenuation factors (AFmax) in the Los Angeles RWQCB guidance document were used. For other VOCs that do not have AFmax in the guidance document, the maximum attenuation factors were calculated from properties of the VOCs following the procedure in the Los Angeles RWQCB guidance document. The VOC properties used in the calculation of AFmax were obtained using the U.S. EPA document "Region IX Preliminary Remediation Goals" (2004),[2] with the exception of isopropyltoluene. The references for the properties of isopropyltoluene were listed in the corresponding Mathcad® worksheet.

Modification factors for the distance above groundwater were applied to the maximum attenuation factors using equations 5 through 7 in the Los Angeles RWQCB guidance document. Modification factors for lithology were then applied to the attenuation factors using equation 12 in the Los Angeles RWQCB guidance document. The site-specific lithologic profile interpreted based on the logs of borings 125 and 126 were used in the calculations. At each depth interval, the lithologic unit was classified as gravel, sand, silt, or clay layer. Finally, site-specific soil screening levels were calculated using the attenuation factors (modified for distance to groundwater and lithology) and maximum allowable concentrations in groundwater. The California Department of Public Health (DPH) maximum contaminant levels (MCLs) were used to calculate the site-specific soil screening levels. In cases where a compound did not

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[1] Parametric Technology Corporation, 2007, Mathcad (version 14.0), Needham, Massachusetts, February.

[2] U.S. Environmental Protection Agency (EPA), 2004, Region IX Preliminary Remediation Goals, (PRGs) 2004.

have a State or Federal MCL, the DPH notification level was used, with the exception of Isopropyltoluene. Because no DPH notification level is available for isopropyltoluene, the DPH notification level for isopropylbenzene was used as a surrogate. The calculations for the soil screening levels for the VOC COPCs are presented in Worksheets D-1 through D-14.

2. SITE-SPECIFIC MODELING OF PCBS IN SOIL AND CONCRETE FOR PROTECTION OF GROUNDWATER

Use of the AF Method in the Los Angeles RWQCB guidance document to evaluate polychlorinated biphenyls (PCBs) in soil and concrete for potential impacts to groundwater is not appropriate because PCBs have significantly higher soil sorption than VOCs for which the AF Method is applicable. The AF Method assumes that the fate and transport processes of VOCs in vadose zone have reached steady state. However, because PCBs have significantly higher soil sorption, the transport of PCBs in vadose zone soil is highly retarded. As a result, the PCB concentrations in vadose zone soil between the source and groundwater table tend to be in a transient condition that occurs long after the initial release. In addition, the modification factor due to distance above groundwater in the AF Method is based on an assumed linear relationship between AF and the distance above groundwater. The linear relationship in the Los Angeles RWQCB guidance document is based on a study of VOC downward transport using a one-dimensional vadose zone transport model, VLEACH (Ravi and Johnson, 1994).[3] Because PCBs have a significantly higher soil sorption than the VOCs, the relationship between AF and the distance above groundwater is likely very different from the relationship used in the AF Method. Without establishing this relationship for PCBs using the VLEACH model, the AF Method is inappropriate to use for PCBs. Instead, numerical simulations were performed to simulate the fate and transport of PCBs in a one-dimensional soil column in the vadose zone. The model developed for PCB attenuation analysis is described below.

The modeling was performed using commercial software, MODFLOW-SURFACT (HydroGeologic, Inc., 2006),[4] which is similar to VLEACH. The code for this software is based on the most commonly used groundwater modeling software, MODFLOW (Harbaugh et., al., 2000),[5] released by the United States Geological Survey. The MODFLOW-SURFACT code has an additional capability to simulate the moisture movement as well as the fate and transport of chemicals in the vadose zone using the Van Genuchten's model. This code was selected because it was supported by a commonly used MODFLOW pre- and post-processing

[3] Ravi, V. and J.A. Johnson, 1994, VLEACH (version 2.1), Center for Subsurface Modeling Support, Robert Kerr Environmental Research Laboratory, Ada, Oklahoma.
[4] HydroGeologic, Inc., 2006, MODFLOW-SURFACT (version 3.0), Reston, Virginia, May.
[5] Harbaugh, A.W., E.R. Banta, M.C. Hill, and M.G. McDonald, 2000, MODFLOW-2000, The U.S. Geological Survey Modular Ground-water Model – User Guide to Modularization Concepts and the Ground-Water Flow Process: U.S. Geological Survey Open-File Report 00-92, p. 121.

graphical user interface software, Groundwater Vista®, which was released by Environmental Simulation, Inc. (2007).[6]

2.1 Model Construction and Parameters

A one-dimensional MODFLOW-SURFACT model was constructed to simulate a one-dimensional soil column. The model domain consisted of one row and one column. Vertically, the model has thirty layers with a uniform thickness of 5 feet to represent the vadose zone and one layer with a thickness of 50 feet to represent the saturated zone. The groundwater table was assumed to be at 150 feet below ground surface (bgs).

The lithologic profile used in the MODFLOW-SURFACT model was based on the logs of on-site Borings 125 and 126; the lithologic profile developed from these two borings was considered representative of site-wide conditions. The hydrogeologic parameters and Van Genuchten's model parameters for each layer were obtained using the computer code ROSETTA (version 1.2) developed by the Salinity Laboratory of the United States Department of Agriculture (2000).[7] The inputs to the ROSETTA code are the percentage of sand, silt, and clay in each layer. For each boring, the percentages of gravel, sand, silt, and clay in 5-foot intervals between the ground surface and the groundwater table were estimated. The percentage of gravel is combined with the percentage of sand as the ROSETTA does not accept percentage of gravel as an input. The percentages in the same interval for the two borings were then averaged to obtain average percentages as input to ROSETTA. In the MODFLOW-SURFACT model for crushed concrete, the hydrogeologic parameters and Van Genuchten's model parameters for gravel were used for the top 15 feet of vadose soil to represent the crushed concrete as fill.

The other model parameters are listed below.

- Soil bulk density, ρ = 96 pounds per cubic feet
- Porosity, $n = 0.40$
- Soil organic carbon content, $f_{oc} = 0.39\%$
- Sorption partition coefficient for PCBs, K_{oc} = 309,000 liters per kilogram

Site-specific soil physical properties were based on the field investigations of the Morrison Knudsen Corporation (1995).[8] The effective porosity value in the model is assumed to be 40 percent, based on an average porosity value of 47 percent. The sorption partition

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[6] Environmental Simulation, Inc., 2007, Groundwater Vista (version 5.01), Reinholds, Pennsylvania, June.
[7] United States Salinity Laboratory, 2000, ROSETTA (version 2.1), Agricultural Research Service, United States Department of Agriculture, November.
[8] Morrison Knudsen Corporation, 1995, Final Report Stoddard Solvent System Field Investigation, Aluminum Company of America, October 27.

coefficient for PCBs was obtained from U.S. EPA guidance (1996).[9] The dispersivity in the model is assumed to be equal to 15 feet, 10 percent of the simulated distance between PCB source and groundwater table (150 feet).

Infiltration was applied to the uppermost model layer. Different infiltration rates were assumed for stress periods of 11 years or one year in length.[10] An average infiltration rate of four inches per year was assumed for each 11-year stress period, which is approximately 25 percent of the average annual precipitation at the Los Angeles Civic Center weather station (the nearest Western Regional Climate Center Station to the city of Vernon) from 1906 to 2010 (14.7 inches per year).[11] Four inches per year of infiltration is considered conservative for a largely paved or vegetated land surface. As a reference, if the infiltration rate is calculated using the recharge model of Williamson et al., 1989,[12]

$$R = \max[(0.64 \times P - 9.1), 0]$$

where, R = infiltration rate (inches/year)
P = precipitation (inches/year)

the infiltration rate is approximately 0.4 inches per year. A study of infiltration rates in Riverside County, which has similar meteorological conditions as the site, by USGS, also suggested that the land surface infiltration rate is much less than 25% of precipitation.[13] Therefore, the infiltration rate of four inches per year is a conservative assumption, even for an unpaved land surface. For each one-year stress period, an infiltration rate of 8.5 inches per year was assumed, which is approximately 25 percent of the highest recorded annual precipitation from the Los Angeles Civic Center weather station from 1906 to 2010 (34.0 inches per year).[11]

A constant head boundary with the specified head equal to the elevation of the top of the bottom layer was applied at the bottom layer to represent the groundwater table elevation in the saturated zone.

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[9] U.S. EPA, 1996, Soil Screening Guidance: Users Guide and Technical Background Document, Office of Solid Waste and Emergency Response, Washington, D.C., EPA/540/R-95/128, May.
[10] The model was set up to run in transient mode for a 500-year period, divided into five 100-year cycles, with each cycle consisting of nine 11-year stress periods with average precipitation (divided into 132 monthly time steps) and one 1-year stress period with 100-year recurrence interval precipitation (divided into 12 monthly time steps).
[11] Western Regional Climate Center, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca5115
[12] Williamson, A.K., D.E. Prudic, and L.A. Swain, 1989, Ground-water flow in the Central Valley, California, U.S. Geological Survey Professional Paper 1401-D.
[13] USGS, Rainfall-Runoff Characteristics and Effects of Increased Urban Density on Streamflow and Infiltration in Eastern Part of the San Jacinto River Basin, Riverside County, California, USGS Water-Resources Investigations Report 02-4090.

2.2 SIMULATIONS

Two separate simulations, one for PCBs in soil and another for PCBs in concrete (assumed to be crushed and re-used as fill on-site), were conducted to evaluate if the detected concentrations in either medium pose a threat to groundwater quality. Specifically, the simulations were used to estimate site-specific attenuation factors for PCBs, which were then used in reverse calculations from the groundwater MCL to calculate the total Aroclor concentrations that would be necessary in the vadose zone to pose a potential threat to groundwater.

2.2.1 PCBs in Soil

The MODFLOW-SURFACT model described above was used to estimate site-specific attenuation factors for PCBs in soil at hypothetical source depths of 15 feet, 30 feet, and 45 feet bgs. These attenuation factors were estimated by having the MODFLOW-SURFACT model simulate the movement of PCBs in pore water from these depths to pore water immediately above the water table (at approximately 150 feet bgs) after 500 years. A constant total Aroclor concentration in pore water of 100 micrograms per liter (µg/L) was assumed at each source depth for the simulations. The attenuation factors were then calculated as the ratios of the source pore water concentration (100 µg/L) to the simulated pore water concentrations immediately above the water table. All calculations using the MODFLOW-SURFACT simulation results were implemented in Mathcad® (version 14; Parametric Technology Corporation, 2007) (Worksheet D-15).

For the hypothetical source depths of 15 and 30 feet bgs, the simulated pore water concentrations immediately above the water table were below the lowest value that the MODFLOW-SURFACT could report ($1x10^{-44}$ µg/L). The minimum reportable concentration ($1x10^{-44}$ µg/L) was therefore used as the simulated pore water concentration immediately above the water table in calculating the attenuation factors for these two cases. As the pore water concentrations immediately above the water table would actually be lower than this minimum reportable value, the simulated attenuation is actually higher than the results would indicate.

As presented in Worksheet D-15, the attenuation factors calculated using this method ranged from $2.2x10^{44}$ to $1x10^{46}$ for source depths of 15 to 45 feet bgs. These attenuation factors are conservative because the dilution of PCBs after entering the saturated zone and the degradation of PCBs in the vadose zone are not considered in the MODFLOW-SURFACT model. These attenuation factors were then used in a reverse calculation from the MCL, 0.5 µg/L, to estimate the source pore water concentrations at 15 feet, 30 feet, and 45 feet bgs that would be necessary to pose a potential threat to groundwater quality. The estimated source pore water concentrations ranged from $1.1x10^{41}$ to $5x10^{42}$ milligrams per liter (mg/L)

(Worksheet D-15). Based on these calculations, the concentration of total Aroclors in source pore water at the Site would need to exceed 1.1×10^{41} mg/L at 45 feet bgs or 5×10^{42} mg/L at 15 to 30 feet bgs to result in groundwater concentrations exceeding the MCL. Because these concentrations greatly exceed the solubility limit of PCBs in water (0.7 mg/L; U.S. EPA, 1996) and exceeds the concentration of pure phase PCBs (1×10^{6} mg/L), it is physically impossible to achieve total Aroclor concentrations in the source pore water that would result in a concentration of total Aroclors exceeding the MCL in groundwater. Therefore, PCBs in soil at the Site do not pose a potential threat to groundwater at the Site.

2.3.2 PCBs in Crushed Concrete

Because crushed concrete containing PCBs may be re-used as on-site fill materials within the upper 15 feet of the vadose zone, the reverse calculation method described above was also used to verify that PCBs in re-used crushed concrete do not pose a potential threat to groundwater quality. The MODFLOW-SURFACT simulation was performed in the same manner as described above for soil, but modified to account for the physical properties associated with crushed concrete. For crushed concrete, the hydrogeologic parameters and Van Genuchten's model parameters for gravel (Fayer et al., 1992)[14] were used rather than the lithologic parameters estimated for the upper 15 feet of the soil column. An attenuation factor was then estimated for PCBs from a source depth of 15 feet bgs, corresponding to the bottom depth of proposed concrete re-use. As presented in Worksheet D-16, the attenuation factor estimated for the concrete re-use scenario was 1×10^{46}, equal to the attenuation factor estimated for PCBs in native soil at 15 or 30 feet bgs (Worksheet D-15). Correspondingly, the source pore water concentration of total Aroclors dissolved from crushed concrete at 15 feet bgs would need to exceed 5×10^{42} mg/L to result in groundwater concentrations exceeding the MCL. As noted earlier for soil, these concentrations greatly exceed the solubility limit of PCBs in water (0.7 mg/L; U.S. EPA, 1996) and exceed the concentration of pure phase PCBs (1×10^{6} mg/L), and therefore it is physically impossible to achieve total Aroclor concentrations in the source pore water from the crushed concrete that would result in a concentration of total Aroclors exceeding the MCL in groundwater. Therefore, PCBs in concrete that may be re-used (on-site disposal) as on-site fill materials also do not pose a potential threat to groundwater at the Site.

[14] Fayer, M. J., M. L. Rockhold, and M. D. Campbell, 1992, Hydrologic Modeling of Protective Barriers: Comparison of Field Data and Simulation Results, Soil Science Society of America Journal, 56: 690-700.

Worksheet D-1
Site-specific Soil Screening Levels for the Protection of Groundwater - TCE

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: December 19, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor $AFmax := 145$ (Table 2 of Appendix A)

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $DT := 150ft$

$i := 1..149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\dfrac{D_i - 40ft}{110ft} + 0.1\right)\cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \dfrac{D_i}{40ft}\cdot(0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$GR125_i := 0 \quad SA125_i := 0 \quad SI125_i := 0 \quad CL125_i := 0$

$GR126_i := 0 \quad SA126_i := 0 \quad SI126_i := 0 \quad CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$$i := 1 .. 149$$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for Soil Screening Levels

- maximum contaminant level $MCL := 0.005$ (California MCL, in ppm)

$$i := 1 .. 149$$

$$conc_i := AFT_i \cdot MCL$$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

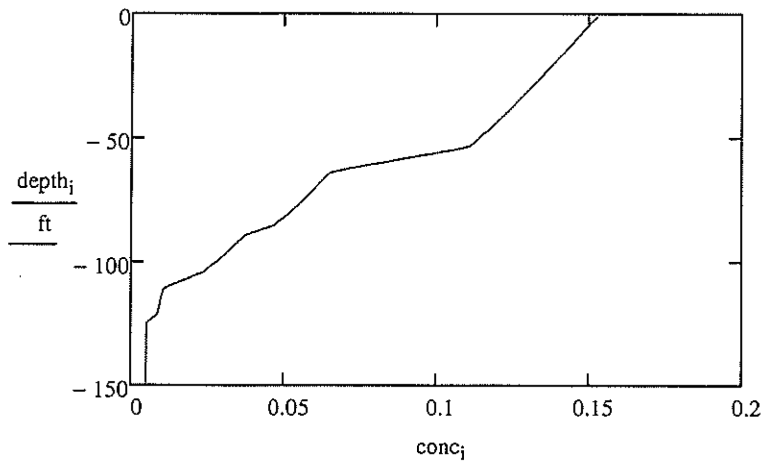


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

TCE.xls

conc

Worksheet D-2
Site-specific Soil Screening Levels for the Protection of Groundwater - PCE

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: December 19, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor $\quad AFmax := 729 \quad$ (Table 2 of Appendix A)

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $\quad DT := 150ft$

$i := 1..149$

depth to water from point of Interst = $\quad D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\dfrac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \dfrac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$GR125_i := 0 \quad SA125_i := 0 \quad SI125_i := 0 \quad CL125_i := 0$

$GR126_i := 0 \quad SA126_i := 0 \quad SI126_i := 0 \quad CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$$i := 1 .. 149$$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- maximum contaminant level $MCL := 0.005$ (California MCL, in ppm)

  $i := 1 .. 149$

  $conc_i := AFT_i \cdot MCL$ (Equation 13 of Appendix A)

  depth of point of interest: $depth_i := -i \cdot ft$

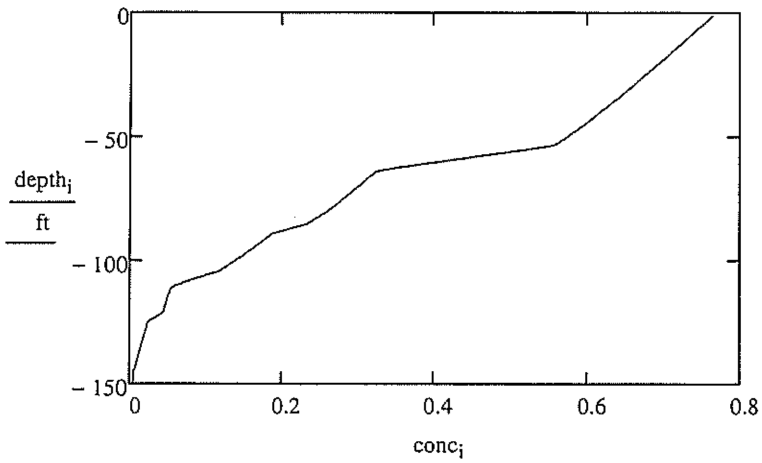


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

PCE.xls

conc

Worksheet D-3
Site-specific Soil Screening Levels for the Protection of Groundwater - Benzene

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17,2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor $AFmax := 73$ (Table 2 of Appendix A)

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $DT := 150ft$

  $i := 1..149$

  depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{vmatrix} \max(1, AFmax) \text{ if } D_i > 150ft \\ \max\left[1, \left(0.9\frac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] \text{ if } 40ft < D_i \le 150ft \\ \max\left[1, \frac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] \text{ if } D_i \le 40ft \end{vmatrix}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

  $i := 1..150$

  $GR125_i := 0$ $SA125_i := 0$ $SI125_i := 0$ $CL125_i := 0$

  $GR126_i := 0$ $SA126_i := 0$ $SI126_i := 0$ $CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$i := 1 .. 149$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- maximum contaminant level $MCL := 0.001$ (California MCL, in ppm)

$i := 1 .. 149$

$conc_i := AFT_i \cdot MCL$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

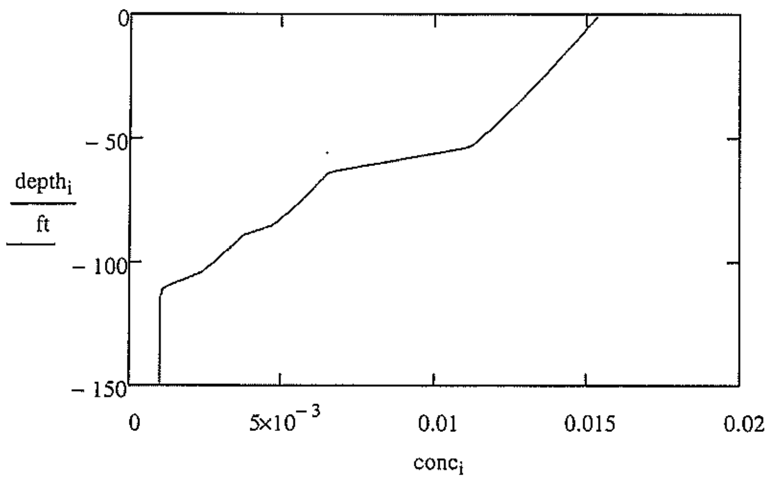


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

benzene.xls

conc

Worksheet D-4
Site-specific Soil Screening Levels for the Protection of Groundwater - Toluene

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor $AFmax := 288$ (Table 2 of Appendix A)

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $DT := 150ft$

$i := 1..149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\dfrac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \dfrac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$GR125_i := 0 \quad SA125_i := 0 \quad SI125_i := 0 \quad CL125_i := 0$

$GR126_i := 0 \quad SA126_i := 0 \quad SI126_i := 0 \quad CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$$i := 1 .. 149$$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- maximum contaminant level $MCL := 0.15$ (California MCL, in ppm)

$i := 1 .. 149$

$conc_i := AFT_i \cdot MCL$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

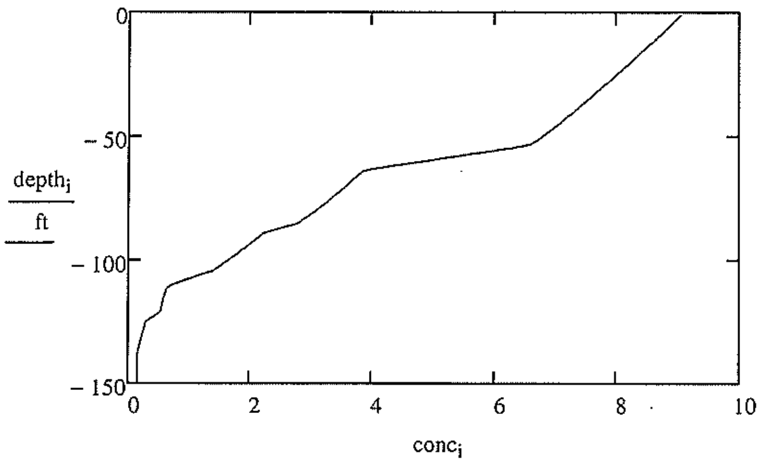


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

toluene.xls

conc

Worksheet D-5
Site-specific Soil Screening Levels for the Protection of Groundwater - Ethylbenzene

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17,2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor

$AFmax := 244$ (Table 2 of Appendix A)

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $DT := 150ft$

$i := 1..149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\frac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \frac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$GR125_i := 0 \quad SA125_i := 0 \quad SI125_i := 0 \quad CL125_i := 0$

$GR126_i := 0 \quad SA126_i := 0 \quad SI126_i := 0 \quad CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$i := 1 .. 149$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- maximum contaminant level $MCL := 0.3$ (California MCL, in ppm)

$i := 1 .. 149$

$conc_i := AFT_i \cdot MCL$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

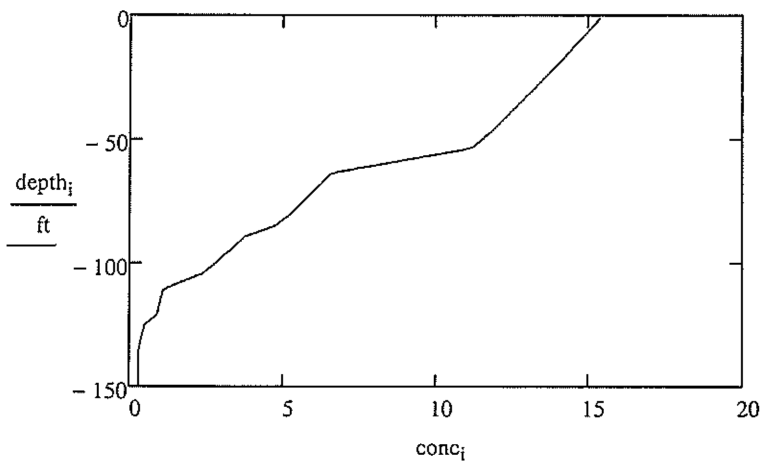


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

ethylbenzene.xls

conc

Worksheet D-6
Site-specific Soil Screening Levels for the Protection of Groundwater - Xylenes

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor $\mathrm{AFmax} := 265$ (Table 2 of Appendix A)

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $\mathrm{DT} := 150\mathrm{ft}$

$i := 1..149$

depth to water from point of Interst = $D_i := \mathrm{DT} - i \cdot \mathrm{ft}$

$$\mathrm{AFD}_i := \left| \begin{array}{l} \max(1, \mathrm{AFmax}) \ \text{ if } D_i > 150\mathrm{ft} \\ \max\left[1, \left(0.9\dfrac{D_i - 40\mathrm{ft}}{110\mathrm{ft}} + 0.1\right) \cdot \mathrm{AFmax}\right] \ \text{ if } 40\mathrm{ft} < D_i \le 150\mathrm{ft} \\ \max\left[1, \dfrac{D_i}{40\mathrm{ft}} \cdot (0.1\mathrm{AFmax} - 1) + 1\right] \ \text{ if } D_i \le 40\mathrm{ft} \end{array} \right.$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$\mathrm{GR125}_i := 0 \quad \mathrm{SA125}_i := 0 \quad \mathrm{SI125}_i := 0 \quad \mathrm{CL125}_i := 0$

$\mathrm{GR126}_i := 0 \quad \mathrm{SA126}_i := 0 \quad \mathrm{SI126}_i := 0 \quad \mathrm{CL126}_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$$i := 1..149$$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- maximum contaminant level $MCL := 1.75$ (California MCL, in ppm)

$$i := 1..149$$

$conc_i := AFT_i \cdot MCL$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

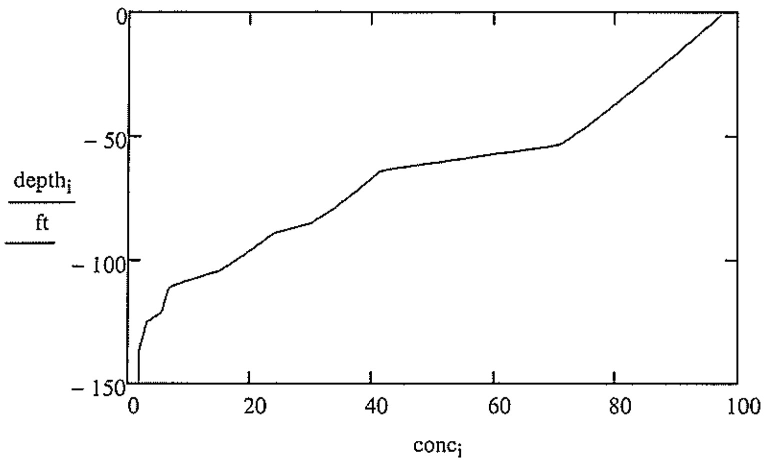


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

xylenes.xls

conc

Worksheet D-7
Site-specific Soil Screening Levels for the Protection of Groundwater - n-Butylbenzene

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor

Non-chemical-specific Parameters

soil bulk density $\quad denb := 2.27 \frac{g}{mL}$

soil water content by volume (dimensionless) $\quad thetaw := 0.031$

soil organic carbon content (dimensionless) $\quad foc := 0.015$

soil porosity (dimensionless) $\quad n := 0.143$

Chemical-specific Parameters

organic carbon partition coefficient $\quad Koc := 2830 \frac{mL}{g}$

Henry's law constant $\quad Kh := 0.537$

Reference: U.S. EPA, 2004, Region IX Preliminary Remediation Goals (PRGs)
http://www.epa.gov/region09/waste/sfund/prg/index.html

Maximum Attenution Factor

$$AFmax := 1 + \left(\frac{denb}{thetaw}\right) \cdot foc \cdot Koc + (n - thetaw) \cdot \frac{Kh}{thetaw}$$ (Equation 4 of Appendix A)

$$AFmax = 3.111 \times 10^{3}$$

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $\quad DT := 150ft$

$i := 1 .. 149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\frac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \frac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$GR125_i := 0 \quad SA125_i := 0 \quad SI125_i := 0 \quad CL125_i := 0$

$GR126_i := 0 \quad SA126_i := 0 \quad SI126_i := 0 \quad CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$i := 1..149$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}}\cdot\left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- water quality objective (WQO) $WQO := 0.26$ (California DHS Notification Level, in ppm)

$i := 1 .. 149$

$conc_i := AFT_i \cdot WQO$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

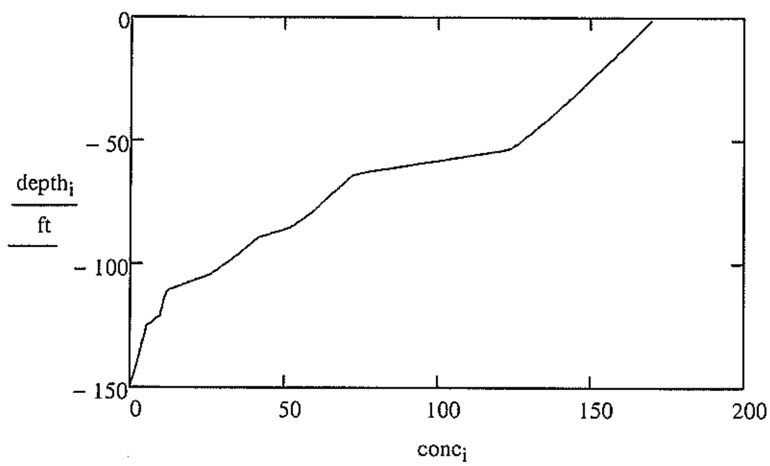


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

n-butylbenzene.xls

conc

Worksheet D-8
Site-specific Soil Screening Levels for the Protection of Groundwater - sec-Butylbenzene

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor

Non-chemical-specific Parameters

soil bulk density $denb := 2.27 \frac{g}{mL}$

soil water content by volume (dimensionless) $thetaw := 0.031$

soil organic carbon content (dimensionless) $foc := 0.015$

soil porosity (dimensionless) $n := 0.143$

Chemical-specific Parameters

organic carbon partition coefficient $Koc := 2150 \frac{mL}{g}$

Henry's law constant $Kh := 0.767$

Reference: U.S. EPA, 2004, Region IX Preliminary Remediation Goals (PRGs)
http://www.epa.gov/region09/waste/sfund/prg/index.html

Maximum Attenution Factor

$$AFmax := 1 + \left(\frac{denb}{thetaw}\right) \cdot foc \cdot Koc + (n - thetaw) \cdot \frac{Kh}{thetaw}$$ (Equation 4 of Appendix A)

$$AFmax = 2.365 \times 10^{3}$$

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $DT := 150ft$

$i := 1 .. 149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\dfrac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \dfrac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$GR125_i := 0 \quad SA125_i := 0 \quad SI125_i := 0 \quad CL125_i := 0$

$GR126_i := 0 \quad SA126_i := 0 \quad SI126_i := 0 \quad CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$i := 1..149$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- water quality objective (WQO) $WQO := 0.26$ (California DHS Notification Level, in ppm)

$i := 1 .. 149$

$conc_i := AFT_i \cdot WQO$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

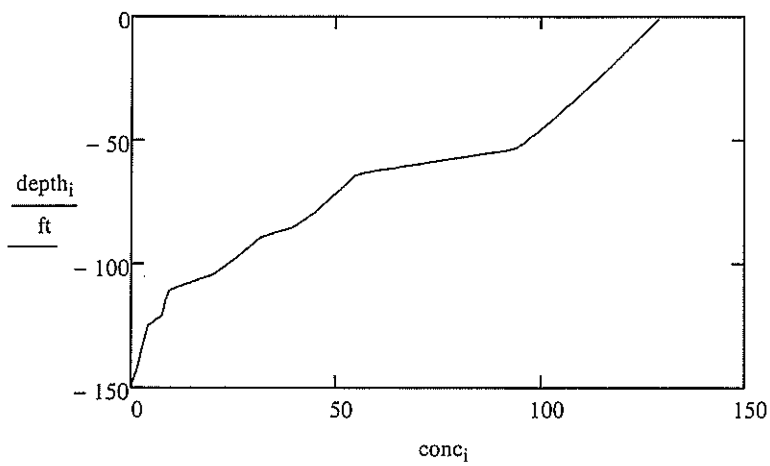


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

sec-butylbenzene.xls

conc

Worksheet D-9
Site-specific Soil Screening Levels for the Protection of Groundwater - 1,2-Dichloroethane

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: May 30, 2008

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

$AFmax := 17$ (Table 2 of Appendix A)

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $DT := 150ft$

$i := 1 .. 149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\dfrac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \dfrac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1 .. 150$

$GR125_i := 0$ $SA125_i := 0$ $SI125_i := 0$ $CL125_i := 0$

$GR126_i := 0$ $SA126_i := 0$ $SI126_i := 0$ $CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$i := 1..149$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- water quality objective (WQO) $WQO := 0.0005$ (California DHS Notification Level, in ppm)

  $i := 1..149$

  $conc_i := AFT_i \cdot WQO$ (Equation 13 of Appendix A)

  depth of point of interest: $depth_i := -i \cdot ft$

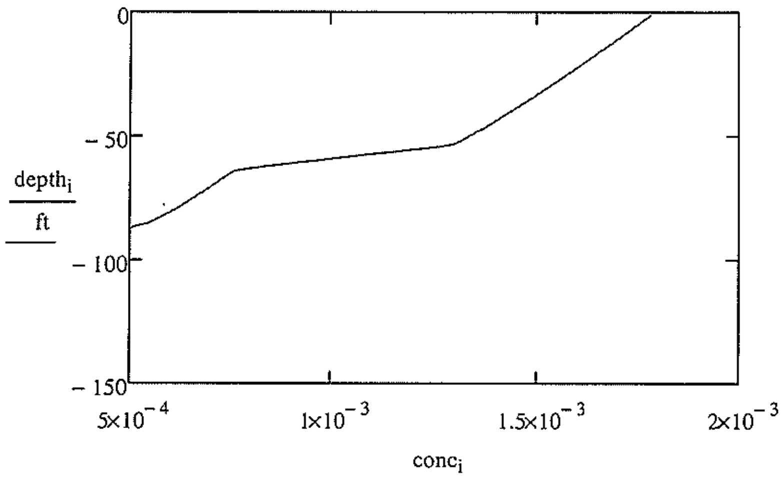


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

12-dca.xls

conc

Worksheet D-10
Site-specific Soil Screening Levels for the Protection of Groundwater - Isopropylbenzene

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor

Non-chemical-specific Parameters

soil bulk density	$denb := 2.27 \frac{g}{mL}$
soil water content by volume (dimensionless)	$thetaw := 0.031$
soil organic carbon content (dimensionless)	$foc := 0.015$
soil porosity (dimensionless)	$n := 0.143$

Chemical-specific Parameters

organic carbon partition coefficient	$Koc := 220 \frac{mL}{g}$
Henry's law constant	$Kh := 0.472$

Reference: U.S. EPA, 2004, Region IX Preliminary Remediation Goals (PRGs)
http://www.epa.gov/region09/waste/sfund/prg/index.html

Maximum Attenution Factor

$$AFmax := 1 + \left(\frac{denb}{thetaw}\right) \cdot foc \cdot Koc + (n - thetaw) \cdot \frac{Kh}{thetaw}$$ (Equation 4 of Appendix A)

$AFmax = 244.35$

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $DT := 150ft$

$i := 1 .. 149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\dfrac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \dfrac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$GR125_i := 0$ $SA125_i := 0$ $SI125_i := 0$ $CL125_i := 0$

$GR126_i := 0$ $SA126_i := 0$ $SI126_i := 0$ $CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$i := 1..149$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- water quality objective (WQO) $WQO := 0.77$ (California DHS Notification Level, in ppm)

$i := 1..149$

$conc_i := AFT_i \cdot WQO$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

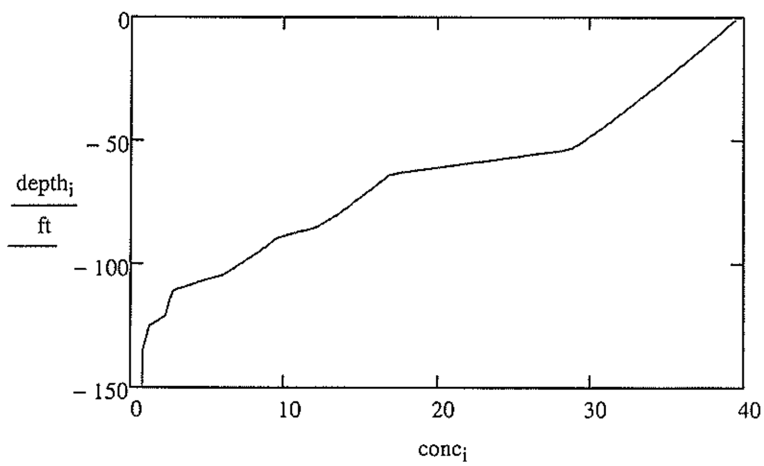


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

isopropylbenzene.xls

conc

Worksheet D-11
Site-specific Soil Screening Levels for the Protection of Groundwater - Isopropyltoluene

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor

Non-chemical-specific Parameters

soil bulk density	$\mathrm{denb} := 2.27 \frac{\mathrm{g}}{\mathrm{mL}}$
soil water content by volume (dimensionless)	$\mathrm{thetaw} := 0.031$
soil organic carbon content (dimensionless)	$\mathrm{foc} := 0.015$
soil porosity (dimensionless)	$\mathrm{n} := 0.143$

Chemical-specific Parameters

organic carbon partition coefficient $\mathrm{Koc} := 3350 \frac{\mathrm{mL}}{\mathrm{g}}$

Reference: PA Phys Prop Database, PA State Dept Bureau of Land Recycling
http://www.dep.state.pa.us/physicalproperties/_cgi-bin/Koc.idc

Henry's law constant $\mathrm{Kh} := 0.508$

Reference: SRC, PhysProp Database, Syracuse Research Corporation,
http://www.syrres.com/esc/physdemo.htm

Maximum Attenution Factor

$$\mathrm{AFmax} := 1 + \left(\frac{\mathrm{denb}}{\mathrm{thetaw}}\right) \cdot \mathrm{foc} \cdot \mathrm{Koc} + (\mathrm{n} - \mathrm{thetaw}) \cdot \frac{\mathrm{Kh}}{\mathrm{thetaw}}$$ (Equation 4 of Appendix A)

$$\mathrm{AFmax} = 3.682 \times 10^{3}$$

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $\mathrm{DT} := 150\mathrm{ft}$

$i := 1 .. 149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\dfrac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \dfrac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1 .. 150$

$GR125_i := 0 \quad SA125_i := 0 \quad SI125_i := 0 \quad CL125_i := 0$

$GR126_i := 0 \quad SA126_i := 0 \quad SI126_i := 0 \quad CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1 .. 15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16 .. 19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20 .. 25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26 .. 47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48 .. 48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49 .. 54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55 .. 64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65 .. 80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81 .. 85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86 .. 89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90 .. 106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107 .. 114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115 .. 121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122 .. 125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126 .. 144$	$SA125_i := 1$
144' - 145': Silt	$i := 145 .. 145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146 .. 150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$i := 1..149$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- water quality objective (WQO) $WQO := 0.77$ (California DHS Notification Level for isopropyltoluene as surrogate, in ppm)

$i := 1 .. 149$

$conc_i := AFT_i \cdot WQO$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

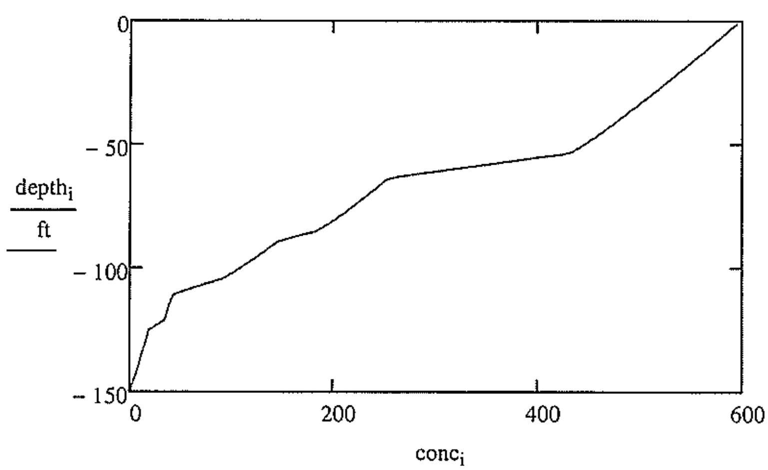


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

isopropyltoluene.xls

conc

Worksheet D-12
Site-specific Soil Screening Levels for the Protection of Groundwater - n-Propylbenzene

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor

Non-chemical-specific Parameters

soil bulk density	$denb := 2.27 \frac{g}{mL}$
soil water content by volume (dimensionless)	$thetaw := 0.031$
soil organic carbon content (dimensionless)	$foc := 0.015$
soil porosity (dimensionless)	$n := 0.143$

Chemical-specific Parameters

organic carbon partition coefficient	$Koc := 2830 \frac{mL}{g}$
Henry's law constant	$Kh := 0.537$

Reference: U.S. EPA, 2004, Region IX Preliminary Remediation Goals (PRGs)
http://www.epa.gov/region09/waste/sfund/prg/index.html

Maximum Attenution Factor

$$AFmax := 1 + \left(\frac{denb}{thetaw}\right) \cdot foc \cdot Koc + (n - thetaw) \cdot \frac{Kh}{thetaw}$$ (Equation 4 of Appendix A)

$$AFmax = 3.111 \times 10^{3}$$

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $DT := 150ft$

$i := 1..149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\dfrac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \dfrac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$GR125_i := 0 \quad SA125_i := 0 \quad SI125_i := 0 \quad CL125_i := 0$

$GR126_i := 0 \quad SA126_i := 0 \quad SI126_i := 0 \quad CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$i := 1..149$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- water quality objective (WQO) $WQO := 0.26$ (California DHS Notification Level, in ppm)

$i := 1 .. 149$

$conc_i := AFT_i \cdot WQO$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

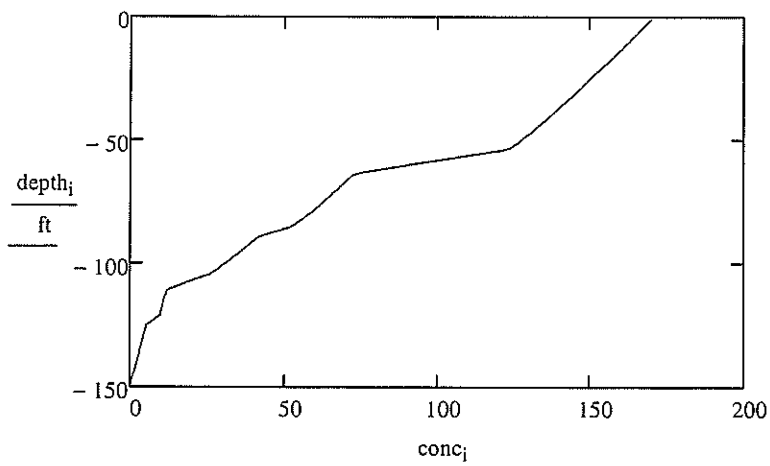


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

n-propylbenzene.xls

conc

Worksheet D-13
Site-specific Soil Screening Levels for the Protection of Groundwater - 1,2,4-Trimethylbenzene

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor

Non-chemical-specific Parameters

soil bulk density	$denb := 2.27 \frac{g}{mL}$
soil water content by volume (dimensionless)	$thetaw := 0.031$
soil organic carbon content (dimensionless)	$foc := 0.015$
soil porosity (dimensionless)	$n := 0.143$

Chemical-specific Parameters

organic carbon partition coefficient	$Koc := 3720 \frac{mL}{g}$
Henry's law constant	$Kh := 0.234$

Reference: U.S. EPA, 2004, Region IX Preliminary Remediation Goals (PRGs)
http://www.epa.gov/region09/waste/sfund/prg/index.html

Maximum Attenution Factor

$$AFmax := 1 + \left(\frac{denb}{thetaw}\right) \cdot foc \cdot Koc + (n - thetaw) \cdot \frac{Kh}{thetaw}$$ (Equation 4 of Appendix A)

$$AFmax = 4.088 \times 10^{3}$$

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $DT := 150ft$

$i := 1 .. 149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\dfrac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \dfrac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$GR125_i := 0 \quad SA125_i := 0 \quad SI125_i := 0 \quad CL125_i := 0$

$GR126_i := 0 \quad SA126_i := 0 \quad SI126_i := 0 \quad CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$i := 1..149$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- water quality objective (WQO) $WQO := 0.33$ (California DHS Notification Level, in ppm)

$i := 1 .. 149$

$conc_i := AFT_i \cdot WQO$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

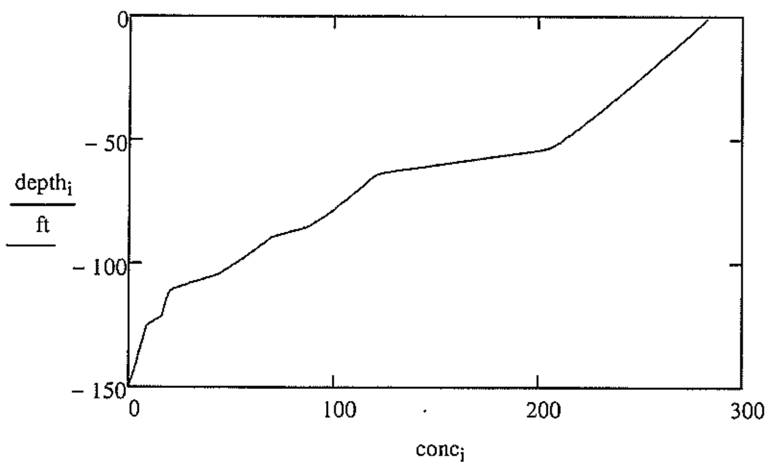


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

depth.xls

124TMB.xls

$\frac{depth}{ft}$

conc

Worksheet D-14
Site-specific Soil Screening Levels for the Protection of Groundwater - 1,3,5-Trimethylbenzene

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 26, 2007
Revision: December 17, 2007

The following calculation is based on Appendix A (referred to as Appendix A in this calculation), "Attenuation Factor Method For VOCs" of "Interim Site Assessment & Cleanup Guidebook" published by the California Regional Water Quality Control Board, Los Angeles Region (referred to as the LARWQCB method in this calculation).

1. Maximum Attenuation Factor (AFmax)

- maximum attenuation factor

Non-chemical-specific Parameters

soil bulk density $\text{denb} := 2.27 \frac{g}{mL}$

soil water content by volume (dimensionless) $\text{thetaw} := 0.031$

soil organic carbon content (dimensionless) $\text{foc} := 0.015$

soil porosity (dimensionless) $n := 0.143$

Chemical-specific Parameters

organic carbon partition coefficient $\text{Koc} := 819 \frac{mL}{g}$

Henry's law constant $\text{Kh} := 0.316$

Reference: U.S. EPA, 2004, Region IX Preliminary Remediation Goals (PRGs)
http://www.epa.gov/region09/waste/sfund/prg/index.html

Maximum Attenution Factor

$$\text{AFmax} := 1 + \left(\frac{\text{denb}}{\text{thetaw}}\right) \cdot \text{foc} \cdot \text{Koc} + (n - \text{thetaw}) \cdot \frac{\text{Kh}}{\text{thetaw}} \qquad \text{(Equation 4 of Appendix A)}$$

$$\text{AFmax} = 901.721$$

2. Modification Factor Due to Distance Above Groundwater (AFD)

- depth to groundwater = $\text{DT} := 150\text{ft}$

$i := 1 .. 149$

depth to water from point of Interst = $D_i := DT - i \cdot ft$

$$AFD_i := \begin{cases} \max(1, AFmax) & \text{if } D_i > 150ft \\ \max\left[1, \left(0.9\frac{D_i - 40ft}{110ft} + 0.1\right) \cdot AFmax\right] & \text{if } 40ft < D_i \le 150ft \\ \max\left[1, \frac{D_i}{40ft} \cdot (0.1AFmax - 1) + 1\right] & \text{if } D_i \le 40ft \end{cases}$$

(Equations 5-7 of Appendix A)

3. Total Modification Factor Due to Distance Above Groundwater and Lithology (AFT)

- boring information::

$i := 1..150$

$GR125_i := 0 \quad SA125_i := 0 \quad SI125_i := 0 \quad CL125_i := 0$

$GR126_i := 0 \quad SA126_i := 0 \quad SI126_i := 0 \quad CL126_i := 0$

Boring No. 125

1' - 15': Silty Sand	$i := 1..15$	$SA125_i := 1$
15' - 19': Poorly Graded Sand	$i := 16..19$	$SA125_i := 1$
19' - 25': Silty Sand	$i := 20..25$	$SA125_i := 1$
25' - 47': Poorly Graded Sand	$i := 26..47$	$SA125_i := 1$
47' - 48': Sandy Silt	$i := 48..48$	$SI125_i := 1$
48' - 54': Silty Sand	$i := 49..54$	$SA125_i := 1$
54' - 64': Lean Clay	$i := 55..64$	$CL125_i := 1$
64' - 80': Poorly Graded Sand	$i := 65..80$	$SA125_i := 1$
80' - 85': Sandy Silt	$i := 81..85$	$SI125_i := 1$
85' - 89': Sandy Lean Clay	$i := 86..89$	$CL125_i := 1$
89' - 106': Poorly Graded Sand	$i := 90..106$	$SA125_i := 1$
106' - 114': Sandy Silt	$i := 107..114$	$SI125_i := 1$
114 - 121': Poorly Graded Sand	$i := 115..121$	$SA125_i := 1$
121 - 125': Silty Sand	$i := 122..125$	$SA125_i := 1$
125' - 144': Poorly Graded Sand	$i := 126..144$	$SA125_i := 1$
144' - 145': Silt	$i := 145..145$	$SI125_i := 1$
145' - 150': Poorly Graded Sand	$i := 146..150$	$SA125_i := 1$

Boring No. 126

1' - 8': Silty Sand	$i := 1..8$	$SA126_i := 1$
8' - 46': Poorly Graded Sand	$i := 9..46$	$SA126_i := 1$
46' - 51': Silty Sand	$i := 47..51$	$SA126_i := 1$
51' - 53': Silt	$i := 52..53$	$SI126_i := 1$
53' - 63': Lean Clay	$i := 54..63$	$CL126_i := 1$
63' - 69': Silty Sand	$i := 64..69$	$SA126_i := 1$
69' - 104': Poorly Graded Sand	$i := 70..104$	$SA126_i := 1$
104' - 111': Lean Clay	$i := 105..111$	$CL126_i := 1$
111' - 121': Poorly Graded Sand	$i := 112..121$	$SA126_i := 1$
121' - 125: Lean Clay	$i := 122..125$	$CL126_i := 1$
125 - 135: Poorly Graded Sand	$i := 126..135$	$SA126_i := 1$
135 - 140': Silty Sand	$i := 136..140$	$SA126_i := 1$
140' - 150': Poorly Graded Sand	$i := 141..150$	$SA126_i := 1$

$i := 1..149$

$$TGR_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} GR125_j + \sum_{j=i+1}^{\frac{DT}{ft}} GR126_j\right)$$

$$TSA_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SA125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SA126_j\right)$$

$$TSI_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} SI125_j + \sum_{j=i+1}^{\frac{DT}{ft}} SI126_j\right)$$

$$TCL_i := 0.5\left(\sum_{j=i+1}^{\frac{DT}{ft}} CL125_j + \sum_{j=i+1}^{\frac{DT}{ft}} CL126_j\right)$$

$$AFT_i := \max\left[1, \frac{AFD_i}{\frac{D_i}{ft}} \cdot \left(\frac{TGR_i}{20} + \frac{TSA_i}{10} + \frac{TSI_i}{5} + \frac{TCL_i}{1}\right)\right]$$ (Equation 12 of Appendix A)

4. Use of Attenuation Factor for VOC Soil Screening Levels

- water quality objective (WQO) $WQO := 0.33$ (California DHS Notification Level, in ppm)

$i := 1 .. 149$

$conc_i := AFT_i \cdot WQO$ (Equation 13 of Appendix A)

depth of point of interest: $depth_i := -i \cdot ft$

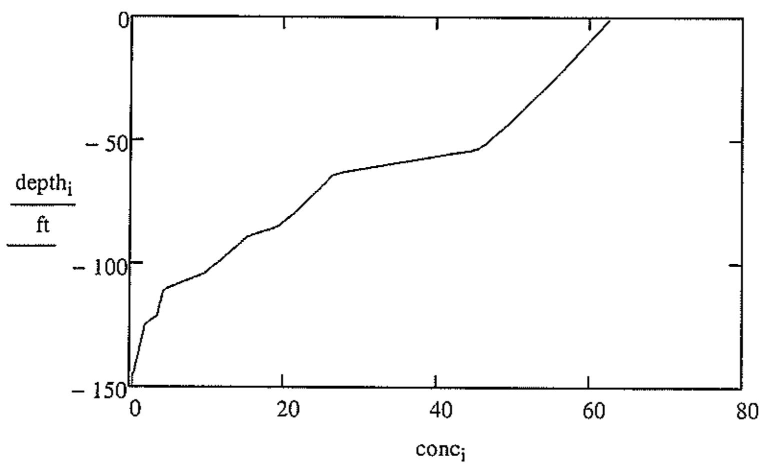


Figure 1. Soil Screening Levels (in ppm) at Various Depths from Ground Surface

135TMB.xls

conc

Worksheet D-15
Site-specific Modeling for the Protection of Groundwater – PCBs in Soil

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 25, 2009

Define Unit: $\mu g := 10^{-6} gm$

Given Parameters:

PCB Solubility in Water $Sw := 0.7 \frac{mg}{L}$

Reference: U.S.EPA Soil Screening Guidance: User's Guide, 2nd Edition, July 1996

Maximum Contaminant Level for PCBs $MCL := 0.5 \cdot \frac{\mu g}{L}$

Calculations:

1. Source at 15 ft bgs

Assumed concentration in pore water at source in MODFLOW-SURFACT simulation:

$$Cps := 100 \frac{\mu g}{L}$$

MODFLOW-SURFACT simulated pore water concentration in layer 30 (just above groundwater table) after 500 years is below the smallest value that the mode can report ($1 x 10^{-44}$). Therefore, $1 x 10^{-44}$ is used as a conservative estimate of the simulated pore water concentration in layer 30.

$$Cws := 1 \cdot 10^{-44} \frac{\mu g}{L}$$

Attenuation factor (i.e. ratio of pore water concentration at source to pore water concentration in layer 30)

$$AF := \frac{Cps}{Cws} \qquad AF = 1 \times 10^{46}$$

Concentration in pore water at source that corresponds to a pore water concentration immediately above the water table equal to the MCL

$$Ci := MCL \cdot AF \qquad Ci = 5 \times 10^{42} \cdot \frac{mg}{L}$$

Ci >> Sw

2. Source at 30 ft bgs

Assumed concentration in pore water at source in MODFLOW-SURFACT simulation:

$$Cps := 100\frac{\mu g}{L}$$

MODFLOW-SURFACT simulated pore water concentration in layer 30 (just above groundwater table) after 500 years is below the smallest value that the mode can report ($1x10^{-44}$). Therefore, $1x10^{-44}$ is used as a conservative estimate of the simulated pore water concentration in layer 30.

$$Cws := 1 \cdot 10^{-44}\frac{\mu g}{L}$$

Attenuation factor (i.e. ratio of pore water concentration at source to pore water concentration in layer 30)

$$AF := \frac{Cps}{Cws} \qquad AF = 1 \times 10^{46}$$

Concentration in pore water at source that corresponds to a pore water concentration immediately above the water table equal to the MCL

$$Ci := MCL \cdot AF \qquad Ci = 5 \times 10^{42} \cdot \frac{mg}{L}$$

Ci >> Sw

3. Source at 45 ft bgs

Assumed concentration in pore water at source in MODFLOW-SURFACT simulation:

$$Cps := 100\frac{\mu g}{L}$$

MODFLOW-SURFACT simulated pore water concentration in layer 30 (just above groundwater table) after 500 years

$$Cws := 4.64 \cdot 10^{-43}\frac{\mu g}{L}$$

Attenuation factor (i.e. ratio of pore water concentration at source to pore water concentration in layer 30)

$$AF := \frac{Cps}{Cws} \qquad AF = 2.155 \times 10^{44}$$

Concentration in pore water at source that corresponds to a pore water concentration immediately above the water table equal to the MCL

$$Ci := MCL \cdot AF \qquad Ci = 1.078 \times 10^{41} \cdot \frac{mg}{L}$$

Ci >> Sw

Worksheet D-16
Site-specific Modeling for the Protection of Groundwater - PCBs in Crushed Concrete

Project Number 010627.003.0

Calculated by: Miao Zhang
Date: June 25, 2009

Define Unit: $\mu g := 10^{-6} gm$

Given Parameters:

PCB Solubility in Water $Sw := 0.7 \frac{mg}{L}$

Reference: U.S.EPA Soil Screening Guidance: User's Guide, 2nd Edition, July 1996

Maximum Contaminant Level for PCBs $MCL := 0.5 \cdot \frac{\mu g}{L}$

Calculations:

Source (crushed concrete) at 15 ft bgs

Assumed concentration in pore water at source in MODFLOW-SURFACT simulation:

$$Cps := 100 \frac{\mu g}{L}$$

MODFLOW-SURFACT simulated pore water concentration in layer 30 (just above groundwater table) after 500 years is below the smallest value that the mode can report (1×10^{-44}). Therefore, 1×10^{-44} is used as a conservative estimate of the simulated pore water concentration in layer 30.

$$Cws := 1 \cdot 10^{-44} \frac{\mu g}{L}$$

Attenuation factor (i.e. ratio of pore water concentration at source to pore water concentration in layer 30)

$$AF := \frac{Cps}{Cws} \qquad AF = 1 \times 10^{46}$$

Concentration in pore water at source that corresponds to a pore water concentration immediately above the water table equal to the MCL

$$Ci := MCL \cdot AF \qquad Ci = 5 \times 10^{42} \cdot \frac{mg}{L}$$

$Ci >> Sw$

APPENDIX E

Regression Analyses of Dioxin TEQ versus Total Aroclors

APPENDIX E

REGRESSION ANALYSES OF DIOXIN TEQ VERSUS TOTAL AROCLORS

As part of the U.S. Environmental Protection Agency's (U.S. EPA's) conditional approval (U.S. EPA, 2010) of the Polychlorinated Biphenyls Notification Plan (PCBNP) (AMEC, 2009), U.S. EPA deferred approval of proposed remediation goals for polychlorinated biphenyls (PCBs) in soil and concrete at the former Pechiney Cast Plate Facility (the Site) until Pechiney could demonstrate that dioxin-like PCB congeners, if present in on-site concrete and/or soil, were not present at more significant concentrations, in terms of potential human health risk, than PCBs as Aroclor mixtures. If potential human health risks were more significant, it was required that Pechiney propose cleanup levels for PCBs in concrete and soil that are adequately protective and do not pose a risk of injury to health or the environment. Based on this requirement, the additional sampling outlined in Section 2.2 of the Sampling and Analysis Plan (SAP) (AMEC, 2010) was conducted in September and October, 2010; the sampling results were evaluated for potential human health concerns; and regression analyses were performed to determine whether or not the proposed risk-based remediation goals for PCBs based on Aroclor mixtures would be adequately protective of PCBs as dioxin-like congeners. The findings of the regression analyses are presented below.

1.0 REGRESSION ANALYSES

Regression analyses were performed with the pairs of dioxin-like PCB congener and Aroclor mixture data to evaluate the potential significance of the relationship between these measurements and determine whether the proposed risk-based remediation goals are adequately protective of potential PCB exposures. Dioxin TEQ and total Aroclor concentrations for the 2010 concrete and soil samples (Tables E-1, E-2, E-3, and E-4) were plotted against each other as representative variables for the dioxin-like PCB congeners and Aroclor mixtures, respectively.

Separate regression analyses were performed for the concrete samples, soil samples, and concrete and soil samples combined. Each regression was made as dioxin TEQ (y-axis) versus total Aroclors (x-axis). For consistency with the treatment of non-detect congeners in the estimation of dioxin TEQ, one half of the reporting limit for non-detect Aroclor mixtures was used in the calculation of total Aroclors, with results for Aroclor-1016, -1232, -1248, -1254, and -1260 factoring into the total Aroclor concentration calculations (i.e., the Aroclor mixtures that were detected at least once in the concrete and soil samples combined).

The data from each sample point were originally plotted by characteristic (i.e., by Phase area and soil sample depth), but no segregation by characteristic was observed. This indicated that there was no basis to perform statistical regressions on separate subsets of concrete or soil samples. Next, linear regressions were performed for the concrete data, soil data, and concrete and soil data combined using the Regression function in Microsoft EXCEL. In these regressions, the line was forced to pass through the origin (the 0,0 point), resulting in a linear equation in the form, $y = mx$, where m is a constant. The 95 percent upper confidence limit (95% UCL) and the 95 percent lower confidence limit (95% LCL) for each regression line were also provided by the Regression function in Microsoft EXCEL, providing upper- and lower-bound estimates, respectively, of the slope (m) of each regression line (i.e., there is less than a 5 percent chance that the true slope of the regression is steeper than the UCL and there is less than a 5 percent chance that the true slope of the regression is less steep than the LCL). The slope of each regression line represents the best estimate of the relationship between dioxin TEQ and total Aroclor concentrations (i.e., the ratio of dioxin TEQ to total Aroclor concentration) for each data set, with the 95% UCL and 95% LCL representing upper- and lower-bound estimates, respectively, of the relationship (ratio) for the data set. These procedures were performed using each data set in an untransformed state (i.e., no logarithmic or other form of transformation was performed on the data prior to the procedures).

The results of the regressions for the untransformed data sets are depicted on Figures E-1, E-2, and E-3 for the concrete data, soil data, and concrete and soil data combined, respectively. As shown in each figure, the results of the regressions were plotted against the proposed risk-based remediation goal for PCBs in concrete and soil that may be left exposed at the surface (upper 5 feet) of 5.3 mg/kg total Aroclors (represented by the black vertical line in each figure), and the equivalent risk-based remediation goal for dioxin-like PCB congeners, 81 pg/g TEQ[1] (represented by the black horizontal line in each figure).

The three regression analyses were repeated using log-transformed data. In this case, the data were transformed using the natural logarithm (symbolized as *ln*). The linear regression was performed on the transformed data using the Regression function in Microsoft EXCEL. In these regressions the line was not forced to pass through the origin. The resulting linear equations had the form of $ln(y) = m\,ln(x)+b$. The 95% UCL and 95% LCL for these linear regressions were calculated using the method described in Schefler (1979). The results of these regressions are depicted on Figures E-4, E-5, and E-6 for the concrete data, soil data, and concrete and soil data combined, respectively. The regressions using log-transformed data estimated two variables, the slope and intercept. Thus, the 95% UCLs and 95% LCLs for these regressions are curved lines. Furthermore, none of the regression lines in the log-transformed domain had

[1] Based on the carcinogenic RBSL for dioxin-like PCB congeners for outdoor commercial/industrial workers (8.1 pg/g TEQ), adjusted to a target cancer risk of 10^{-5}.

a slope that was exactly unity (1.000), which results in curved lines in the non-transformed domain. In this case, neither the regression lines derived from the transformed data nor the corresponding UCLs or LCLs can be used to estimate the ratio of dioxin TEQ to total Aroclor concentration; however, they can be used to calculate a total Aroclor concentration corresponding to a specified dioxin TEQ.[2]

To compare the relative strength of each regression, the F-statistic for each regression was provided by the Regression function in Microsoft EXCEL. The F-statistic is the ratio of a measure of the goodness of the fit of the regression to the data to a measure of the poorness of the fit. A larger F-statistic corresponds to a better fit of the regression to the data. The resulting F-statistics are provided, along with additional characteristics of each regression, in Table E-5. The F-statistic for each of the six regressions exceeded its respective critical value of F corresponding to a significance of 5% (comparable to 95% confidence). These critical values are the minimum value of the F-statistic needed to achieve a statistical significance of 5%. That all F-statistics exceeded their respective critical values indicates high strength for all of the regressions. The statistical significance of the F-statistics for the six regressions ranged from 2.49×10^{-4} to 3.33×10^{-30} (lower values represent greater strength). .

The regression with the strongest F-statistic was the regression using the untransformed combined soil and concrete data. Furthermore, this regression using untransformed data has "physical significance," in that the slopes of the regression line, the UCL, and the LCL are estimators of the ratio between dioxin TEQ and total Aroclor concentration. As shown on Figure E-3, this regression identifies a concentration of total Aroclors at the risk-based remediation goal equivalent for dioxin TEQ (81 pg/g) that is less than the originally proposed risk-based remediation goal of 5.3 mg/kg for concrete and shallow soil (upper 5 feet). Specifically, the total Aroclor concentrations corresponding to 81 pg/g dioxin TEQ on the regression line, the UCL, and the LCL are 3,540, 3,450, and 3,640 μg/kg (3.54, 3.45, and 3.64 mg/kg), respectively. As a result, it would appear that a revised risk-based remediation goal for PCBs (as total Aroclors) of 3.5 mg/kg for concrete and soil that may be left exposed at the surface (at a depth interval of 0 to 5 feet bgs) would be adequately protective of PCBs as dioxin-like congeners. To determine if the originally proposed risk-based remediation goal for PCBs (as total Aroclors) in deeper soil of 35 mg/kg would be adequately protective, the results of the regression for the combined soil and concrete data (untransformed) were also plotted against this remediation goal along with the

[2] The ratio of dioxin TEQ to total Aroclor concentration is the relationship between dioxin TEQ and total Aroclor concentration and should be independent of the magnitude of the total Aroclor concentration (i.e., the ratio should be constant with respect to total Aroclor concentration). That the regressions using log-transformed data yield curved lines in the non-transformed domain means that the regressions using log-transformed data suggest that the ratio varies with total Aroclor concentration, which should not be the case.

equivalent risk-based remediation goal for dioxin-like PCB congeners, 530 pg/g TEQ.[3] As shown in Figure E-3, the regression using the combined soil and concrete data (untransformed) identifies a concentration of total Aroclors at the risk-based remediation goal equivalent for dioxin TEQ (530 pg/g) that is less than 35 mg/kg. As a result, it would appear that a revised risk-based remediation goal for PCBs (as total Aroclors) of 23 mg/kg for soil to be left below pavement or other ground cover that only construction workers may come into contact with during construction (or 5 feet below crushed concrete containing less than 3.5 mg/kg) would be adequately protective of PCBs as dioxin-like congeners.

[3] Based on the carcinogenic RBSL for dioxin-like PCB congeners for construction workers (53 pg/g TEQ), adjusted to a target cancer risk of 10^{-5}.

2.0 REFERENCES

AMEC Geomatrix, Inc. (AMEC), 2009, Polychlorinated Biphenyls Notification Plan, Former Pechiney Cast Plate Facility, Vernon, California, July 10.

AMEC, 2010, Sampling and Analysis Plan, Former Pechiney Cast Plate Facility, Vernon, California, July 27.

Schefler, W.C., 1979, Statistics for the Biological Sciences, 2nd Edition, Addison-Wesley, Reading, MA.

United States Environmental Protection Agency (U.S. EPA), 2010, Polychlorinated Biphenyls – U.S. EPA Conditional Approval Under 40 CFR 761.61(c), Toxic Substances Control Act – "Polychlorinated Biphenyls Notification Plan, Former Pechiney Cast Plate, Inc., Facility, Vernon, California, July 9, 2009," Letter from Jeff Scott, Director, Waste Management Division, to Donald Thompson, President Pechiney Cast Plate, July 2.

TABLE E-1

POLYCHLORINATED BIPHENYLS IN CONCRETE (SEPTEMBER - OCTOBER 2010)

Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Results shown in micrograms per kilogram (µg/kg)

Sample Location	Sample ID	Phase Area	Sample Depth[1] (Feet)	Sample Date	EPA Method	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total Aroclors (Sum of Detected Aroclors)	Data Source
C-12	C-12-A	I	0	09/15/10	8082	<20[2]	<20	<20	<20	110	<20	<20	110	AMEC Geomatrix
DC-154	DC-154-A	I	0	09/15/10	8082	<1000	<1000	<1000	<1000	12,000	<1000	1400	13,400	AMEC Geomatrix
DC-168	DC-168-C	I	0	09/15/10	8082	<20,000	<20,000	<20,000	<20,000	390,000	<20,000	200,000	590,000	AMEC Geomatrix
DC-168	DC-168-A/DC-168-B	I	0	09/15/10	8082	<20,000	<20,000	<20,000	<20,000	160,000	<20,000	40,000	200,000	AMEC Geomatrix
DC-205	DC-205-A	I	0	09/14/10	8082	<20	<20	<20	<20	41	<20	31	72	AMEC Geomatrix
DC-206	DC-206-A	I	0	09/14/10	8082	<20	<20	<20	<20	50	<20	26	76	AMEC Geomatrix
DC-207	DC-207-A	I	0	09/14/10	8082	<1000	<1000	<1000	<1000	2300	<1000	<1000	2300	AMEC Geomatrix
DC-208	DC-208-A	I	0	09/14/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-209	DC-209-A	I	0	09/14/10	8082	<20	<20	<20	<20	20	<20	<20	20	AMEC Geomatrix
DC-210	DC-210-A	I	0	09/15/10	8082	<20	<20	<20	<20	29	<20	<20	29	AMEC Geomatrix
DC-211	DC-211-A	I	0	09/14/10	8082	<100	<100	<100	<100	1400	<100	780	2180	AMEC Geomatrix
DC-212	DC-212-A	I	0	09/14/10	8082	<20	<20	<20	<20	43	<20	<20	43	AMEC Geomatrix
DC-213	DC-213-A	I	0	09/15/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-214	DC-214-A1	I	0	09/14/10	8082	<20	<20	<20	<20	220	<20	43	263	AMEC Geomatrix
DC-215	DC-215-A	I	0	09/14/10	8082	<20	<20	<20	<20	140	<20	31	171	AMEC Geomatrix
DC-216	DC-216-A	I	0	09/15/10	8082	<200	<200	<200	<200	1900	<200	720	2620	AMEC Geomatrix
DC-217	DC-217-A	I	0	09/13/10	8082	<20	<20	<20	<20	<20	230	130	360	AMEC Geomatrix
DC-218	DC-218-A	I	0	09/13/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-263	DC-263-A	I	0	10/15/10	8082	<100	<100	<100	<100	1000	<100	120	1120	AMEC Geomatrix
DC-264	DC-264-A	I	0	10/15/10	8082	<400	<400	<400	<400	3800	5400	2200	11,400	AMEC Geomatrix
DC-265	DC-265-A	I	0	10/15/10	8082	<200	<200	<200	<200	380	690	340	1410	AMEC Geomatrix
DC-266	DC-266-A	I	0	10/15/10	8082	<400	<400	<400	<400	4100	5800	2200	12,100	AMEC Geomatrix
DC-267	DC-267-A	I	0	10/18/10	8082	<200	<200	<200	<200	770	<200	370	1140	AMEC Geomatrix
DC-268	DC-268-A	I	0	10/18/10	8082	<200	<200	<200	<200	540	<200	200	740	AMEC Geomatrix
DC-269	DC-269-A	I	0	10/18/10	8082	<20	<20	<20	<20	34	<20	24	58	AMEC Geomatrix
DC-270	DC-270-A	I	0	10/18/10	8082	<200	<200	<200	<200	1000	2700	1000	4700	AMEC Geomatrix
DC-271	DC-271-A	I	0	10/18/10	8082	<200	<200	<200	<200	310	<200	<200	310	AMEC Geomatrix
DC-272	DC-272-A	I	0	10/18/10	8082	<200	<200	<200	<200	650	<200	<200	650	AMEC Geomatrix
DC-273	DC-273-A	I	0	10/18/10	8082	<200	<200	<200	<200	420	<200	<200	420	AMEC Geomatrix
DC-274	DC-274-A	I	0	10/18/10	8082	<200	<200	<200	<200	460	<200	<200	460	AMEC Geomatrix

TABLE E-1

POLYCHLORINATED BIPHENYLS IN CONCRETE (SEPTEMBER - OCTOBER 2010)

Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Results shown in micrograms per kilogram (µg/kg)

Sample Location	Sample ID	Phase Area	Sample Depth[1] (Feet)	Sample Date	EPA Method	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total Aroclors (Sum of Detected Aroclors)	Data Source
DC-275	DC-275-A	I	0	10/18/10	8082	<200	<200	<200	<200	1300	<200	440	1740	AMEC Geomatrix
DC-276	DC-276-A	I	0	10/18/10	8082	<20,000	<20,000	<20,000	<20,000	99,000	<20,000	<20,000	99,000	AMEC Geomatrix
C-14	C-14-A	IIA/IIB	0	09/15/10	8082	<20	<20	<20	<20	38	<20	74	112	AMEC Geomatrix
DC-22	DC-22-A	IIA/IIB	0	09/15/10	8082	<20	<20	<20	<20	39	<20	130	169	AMEC Geomatrix
DC-23	DC-23-A	IIA/IIB	0	09/15/10	8082	<20	<20	<20	<20	370	<20	810	1180	AMEC Geomatrix
DC-52	DC-52-A	IIA/IIB	0	09/15/10	8082	<20	<20	<20	<20	41	<20	33	74	AMEC Geomatrix
DC-219	DC-219-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	38	<20	<20	38	AMEC Geomatrix
DC-220	DC-220-A	IIA/IIB	0	09/14/10	8082	<20	<20	<20	<20	97	100	96	293	AMEC Geomatrix
DC-221	DC-221-A	IIA/IIB	0	09/14/10	8082	<20	<20	<20	<20	97	<20	61	158	AMEC Geomatrix
DC-222	DC-222-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	22	<20	29	51	AMEC Geomatrix
DC-223	DC-223-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	1300	<20	96	1396	AMEC Geomatrix
DC-224	DC-224-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	<20	<20	20	20	AMEC Geomatrix
DC-225	DC-225-A	IIA/IIB	0	09/10/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-226	DC-226-A1	IIA/IIB	0	09/10/10	8082	<20	<20	<20	<20	<20	<20	28	28	AMEC Geomatrix
DC-227	DC-227-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	<20	260	150	410	AMEC Geomatrix
DC-228	DC-228-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-229	DC-229-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	39	<20	50	89	AMEC Geomatrix
DC-230	DC-230-A	IIA/IIB	0	09/10/10	8082	26	<20	<20	<20	36	<20	42	104	AMEC Geomatrix
DC-231	DC-231-A	IIA/IIB	0	09/10/10	8082	<20	<20	<20	<20	20	<20	20	40	AMEC Geomatrix
DC-236	DC-236-A	IIA/IIB	0	09/10/10	8082	<20	<20	<20	<20	<20	<20	24	24	AMEC Geomatrix
DC-246	DC-246-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	<20	57	39	96	AMEC Geomatrix
DC-247	DC-247-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	28	<20	62	90	AMEC Geomatrix
DC-248	DC-248-A	IIA/IIB	0	09/13/10	8082	<1000	<1000	<1000	<1000	65,000	<1000	2800	67,800	AMEC Geomatrix
DC-249	DC-249-A1	IIA/IIB	0	09/15/10	8082	<20	<20	<20	<20	45	<20	<20	45	AMEC Geomatrix
DC-250	DC-250-A	IIA/IIB	0	09/14/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-251	DC-251-A	IIA/IIB	0	09/14/10	8082	<20	<20	<20	<20	77	<20	45	122	AMEC Geomatrix
DC-252	DC-252-A	IIA/IIB	0	09/14/10	8082	<20	<20	<20	<20	44	<20	20	64	AMEC Geomatrix
DC-253	DC-253-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	<20	<20	25	25	AMEC Geomatrix
DC-254	DC-254-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	40	<20	<20	40	AMEC Geomatrix
DC-255	DC-255-A	IIA/IIB	0	10/15/10	8082	<200	<200	<200	<200	1600	<200	150	1750	AMEC Geomatrix

TABLE E-1

POLYCHLORINATED BIPHENYLS IN CONCRETE (SEPTEMBER - OCTOBER 2010)

Former Pechiney Cast Plate, Inc., Facility

Vernon, California

Results shown in micrograms per kilogram (µg/kg)

Sample Location	Sample ID	Phase Area	Sample Depth[1] (Feet)	Sample Date	EPA Method	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total Aroclors (Sum of Detected Aroclors)	Data Source
DC-256	DC-256-A	IIA/IIB	0	10/15/10	8082	<20	<20	<20	<20	310	<20	72	382	AMEC Geomatrix
DC-257	DC-257-A	IIA/IIB	0	10/15/10	8082	<40	<40	<40	<40	210	<40	61	271	AMEC Geomatrix
DC-258	DC-258-A	IIA/IIB	0	10/15/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-259	DC-259-A	IIA/IIB	0	10/15/10	8082	<20	<20	<20	<20	24	<20	61	85	AMEC Geomatrix
DC-260	DC-260-A	IIA/IIB	0	10/15/10	8082	<200	<200	<200	<200	1800	<200	<200	1800	AMEC Geomatrix
DC-261	DC-261-A	IIA/IIB	0	10/15/10	8082	<20	<20	<20	<20	56	<20	<20	56	AMEC Geomatrix
DC-262	DC-262-A	IIA/IIB	0	10/15/10	8082	<200	<200	<200	<200	280	<200	<200	280	AMEC Geomatrix
B-1	B-1-A1	IV	0	09/15/10	8082	<20	<20	<20	<20	320	<20	280	600	AMEC Geomatrix
DC-25	DC-25-A	IV	0	09/15/10	8082	<20	<20	<20	<20	<20	<20	28	28	AMEC Geomatrix
DC-232	DC-232-A	IV	0	09/10/10	8082	<20	<20	<20	<20	<20	1000	<20	1000	AMEC Geomatrix
DC-233	DC-233-A	IV	0	09/10/10	8082	<20	<20	<20	<20	53	<20	260	313	AMEC Geomatrix
DC-234	DC-234-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	40	40	AMEC Geomatrix
DC-235	DC-235-A	IV	0	09/10/10	8082	320	<200	<200	<200	<200	<200	210	530	AMEC Geomatrix
DC-237	DC-237-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	86	86	AMEC Geomatrix
DC-238	DC-238-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	40	40	AMEC Geomatrix
DC-239	DC-239-A	IV	0	09/09/10	8082	27	<20	<20	<20	<20	<20	65	92	AMEC Geomatrix
DC-240	DC-240-A	IV	0	09/09/10	8082	<200	<200	<200	<200	<200	<200	<200	<200	AMEC Geomatrix
DC-241	DC-241-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	20	20	AMEC Geomatrix
DC-242	DC-242-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	24	24	AMEC Geomatrix
DC-243	DC-243-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	23	23	AMEC Geomatrix
DC-244	DC-244-A	IV	0	09/09/10	8082	41	<20	<20	<20	58	<20	82	181	AMEC Geomatrix
DC-245	DC-245-A	IV	0	09/10/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix

Notes:
1. Depth = top of sample depth measured in feet below ground surface.
2. < = not detected at or above the reporting limit shown.

Data Source:
AMEC Geomatrix = "B", "C", and "DC" concrete samples collected during PCB characterization and verification sampling.

TABLE E-2

POLYCHLORINATED BIPHENYLS IN SOIL (SEPTEMBER - OCTOBER 2010)
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Results shown in micrograms per kilogram (µg/kg)

Sample	Phase Area	Sample Depth[1]	Sample Date	EPA Method	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total Aroclors (Sum of Detected Aroclors)	Excavated Status[2]	Data Source
Industrial PRGs					21,246	NE[3]	NE	NE	NE	744	NE	NE	--	--
184-SS-01	I	1.7	09/13/10	8082	<20[4]	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
185-SS-01	I	2.4	09/13/10	8082	<20	<20	<20	<20	190	<20	<20	190	--	AMEC Geomatrix
187-SS-01	I	1.8	09/14/10	8082	<20	<20	<20	<20	47	<20	51	98	--	AMEC Geomatrix
190-SS-01	I	0.9	09/24/10	8082	<20	<20	<20	<20	80	<20	<20	80	--	AMEC Geomatrix
191-SS-01	I	1.0	09/24/10	8082	<1000	<1000	<1000	<1000	**11,000**	<1000	<1000	**11,000**	--	AMEC Geomatrix
192-SS-01	I	0.9	09/24/10	8082	<20	<20	<20	<20	23	<20	<20	23	--	AMEC Geomatrix
193-SS-01	I	1.0	09/24/10	8082	<100,000	<100,000	<100,000	<100,000	**1,000,000**	<100,000	<100,000	**1,000,000**	--	AMEC Geomatrix
194-SS-01	I	0.9	09/24/10	8082	<400	<400	<400	<400	450	<400	<400	450	--	AMEC Geomatrix
195-SS-01	I	0.9	09/24/10	8082	<10,000	<10,000	<10,000	<10,000	**94,000**	<10,000	<10,000	**94,000**	--	AMEC Geomatrix
196-SS-01	I	0.8	09/24/10	8082	<20	<20	<20	<20	730	<20	150	**880**	--	AMEC Geomatrix
197-SS-01	I	0.9	09/24/10	8082	<100	<100	<100	<100	390	<100	<100	390	--	AMEC Geomatrix
198-SS-01	I	0.9	09/24/10	8082	<40	<40	<40	<40	190	<40	<40	190	--	AMEC Geomatrix
199-SS-01	I	0.9	09/24/10	8082	<40	<40	<40	<40	160	<40	110	270	--	AMEC Geomatrix
200-SS-01	I	1.0	09/24/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
201-SS-01	I	1.0	09/24/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
202-SS-01	I	1.2	09/24/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
203-SS-01	I	1.1	09/24/10	8082	250	<40	<40	<40	<40	<40	<40	250	--	AMEC Geomatrix
204-SS-01	I	0.9	09/24/10	8082	<200	<200	<200	<200	**1800**	<200	<200	**1800**	--	AMEC Geomatrix
205-SS-01	I	0.9	09/24/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
206-SS-01	I	0.9	09/24/10	8082	<200	<200	<200	<200	**1100**	<200	<200	**1100**	--	AMEC Geomatrix
208-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
209-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
210-SS-01	I	1.1	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
211-SS-01	I	1.8	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
212-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
213-SS-01	I	1.0	09/24/10	8082	<100	<100	<100	<100	240	<100	<100	240	--	AMEC Geomatrix
214-SS-01	I	0.9	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
215-SS-01	I	1.1	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
216-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
217-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
218-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
219-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
220-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
178-SS-01	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	270	<20	180	450	--	AMEC Geomatrix
181-SS-01	IIA/IIB	5.7	09/13/10	8082	<20	<20	<20	<20	54	56	30	140	--	AMEC Geomatrix
182-SS-01	IIA/IIB	5.7	09/13/10	8082	<1000	<1000	<1000	<1000	**14,000**	**19,000**	**26,000**	**59,000**	--	AMEC Geomatrix
188-SS-01	IIA/IIB	2.3	09/13/10	8082	38	<20	<20	<20	<20	<20	<20	38	--	AMEC Geomatrix
189-SS-01	IIA/IIB	4.7	09/14/10	8082	<20	<20	610	<20	<20	<20	<20	610	--	AMEC Geomatrix
189-SS-02	IIA/IIB	9.7	09/14/10	8082	<100	<100	<100	<100	**1400**	<100	<100	**1400**	--	AMEC Geomatrix

TABLE E-2

POLYCHLORINATED BIPHENYLS IN SOIL (SEPTEMBER - OCTOBER 2010)
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Results shown in micrograms per kilogram (µg/kg)

Sample	Phase Area	Sample Depth[1]	Sample Date	EPA Method	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total Aroclors (Sum of Detected Aroclors)	Excavated Status[2]	Data Source
Industrial PRGs					21,246	NE[3]	NE	NE	NE	744	NE	NE	--	--
221-SS-01	IIA/IIB	0.8	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
222-SS-01	IIA/IIB	0.7	09/23/10	8082	<20	<20	<20	<20	<20	84	<20	84	--	AMEC Geomatrix
223-SS-01	IIA/IIB	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
224-SS-01	IIA/IIB	0.7	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
225-SS-01	IIA/IIB	0.7	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
226-SS-01	IIA/IIB	0.7	09/23/10	8082	<20	<20	<20	<20	120	<20	<20	120	--	AMEC Geomatrix
227-SS-01	IIA/IIB	0.8	09/23/10	8082	<20	<20	<20	<20	<20	150	<20	150	--	AMEC Geomatrix
228-SS-01	IIA/IIB	0.7	09/23/10	8082	<100	<100	<100	<100	**3200**	<100	610	**3810**	--	AMEC Geomatrix
229-SS-01	IIA/IIB	1.0	09/23/10	8082	<10,000	<10,000	<10,000	<10,000	**610,000**	<10,000	**22,000**	**632,000**	--	AMEC Geomatrix
230-SS-01	IIA/IIB	0.9	09/24/10	8082	<10,000	<10,000	<10,000	<10,000	**1,500,000**	<10,000	**40,000**	**1,540,000**	--	AMEC Geomatrix
231-SS-01	IIA/IIB	0.8	09/24/10	8082	<10,000	<10,000	<10,000	<10,000	**1,500,000**	<10,000	**60,000**	**1,560,000**	--	AMEC Geomatrix
232-SS-01	IIA/IIB	0.9	09/24/10	8082	<4000	<4000	<4000	<4000	**31,000**	<4000	<4000	**31,000**	--	AMEC Geomatrix
233-SS-01	IIA/IIB	0.8	09/24/10	8082	<10,000	<10,000	<10,000	<10,000	**1,900,000**	<10,000	**55,000**	**1,955,000**	--	AMEC Geomatrix
234-SS-01	IIA/IIB	0.9	09/24/10	8082	<20	<20	<20	<20	250	<20	<20	250	--	AMEC Geomatrix
235-SS-01	IIA/IIB	1.0	09/24/10	8082	<20	<20	<20	<20	230	<20	<20	230	--	AMEC Geomatrix
236-SS-01	IIA/IIB	0.8	09/24/10	8082	<10,000	<10,000	<10,000	<10,000	**1,100,000**	<10,000	**23,000**	**1,123,000**	--	AMEC Geomatrix
237-SS-01	IIA/IIB	0.7	09/24/10	8082	<20	<20	<20	<20	220	<20	<20	220	--	AMEC Geomatrix
238-SS-01	IIA/IIB	0.8	09/24/10	8082	<100	<100	<100	<100	660	<100	<100	660	--	AMEC Geomatrix
175-SS-01	IIIA	2.7	09/13/10	8082	<20	<20	<20	<20	**3400**	<20	500	**3900**	--	AMEC Geomatrix
175-SS-01 [5]	IIIA	2.7	09/13/10	8082	<200	<200	<200	<200	**3500**	**3900**	720	**8120**	--	AMEC Geomatrix
175-SS-01 [5]	IIIA	2.7	09/13/10	8082	<200	<200	<200	<200	**3900**	**3900**	**780**	**8580**	--	AMEC Geomatrix
176-SS-01	IIIA	4.5	09/14/10	8082	<100	<100	<100	<100	**20,000**	<100	**860**	**20,860**	--	AMEC Geomatrix
177-SS-01	IIIA	4.5	09/14/10	8082	<20	<20	<20	<20	130	<20	<20	130	--	AMEC Geomatrix
180-SS-01	IIIA	4.5	09/14/10	8082	<20	<20	<20	<20	65	<20	26	91	--	AMEC Geomatrix
180-SS-02	IIIA	9.5	09/14/10	8082	<20	<20	<20	<20	160	<20	<20	160	--	AMEC Geomatrix
179-SS-01	IV	0.8	09/13/10	8082	<100	<100	<100	<100	130	<100	340	470	--	AMEC Geomatrix
183-SS-01	IV	0.8	09/13/10	8082	<20	<20	<20	<20	680	**2300**	350	**3330**	--	AMEC Geomatrix
183-SS-01 [5]	IV	0.8	09/13/10	8082	<200	<200	<200	<200	680	**2000**	380	**3060**	--	AMEC Geomatrix
183-SS-01 [5]	IV	0.8	09/13/10	8082	<200	<200	<200	<200	650	**2200**	410	**3260**	--	AMEC Geomatrix
186-SS-01	VI	2.0	09/14/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix

Notes:
1. Depth = top of sample depth measured in feet below ground surface.
2. Samples which have been previously excavated are listed "excavated".
3. NE = not established.
4. < = not detected at or above the reporting limit shown.
5. Samples were reanalyzed to verify concentrations of PCB aroclors in primary samples. Samples were analyzed past the EPA-recommended hold time.

Data Source:
AMEC Geomatrix = soil samples collected during additional PCB sampling outlined in the Sampling and Analysis Plan.

TABLE E-3

DIOXIN-LIKE POLYCHLORINATED BIPHENYL (PCB) CONGENERS AND DIOXIN TEQs IN CONCRETE

Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Concentrations reported in picograms per gram (pg/g)

Sample Location	Sample ID	Phase Area	Sample Depth[1]	Sample Date	PCB 77	PCB 81	PCB 105	PCB 114	PCB 118	PCB 123	PCB 126	PCB 156, 157	PCB 167	PCB 169	PCB 189	Dioxin TEQ[2]
				WHO 2005 TEF[3]	0.0001	0.0003	0.00003	0.00003	0.00003	0.00003	0.1	0.00003	0.00003	0.03	0.00003	--[4]
C-12	C-12-A	I	0	09/15/10	190 J	<11.7[5] UJ	825	<45.5	1440	<39.5	<52.6	143	49.0	<15.9	19.9	2.96
DC-154	DC-154-A	I	0	09/15/10	119,000	4660	457,000	28,900	703,000	11,500	5960	44,700	13,200	<564	2630	656
DC-168	DC-168-C	I	0	09/15/10	2,730,000	164,000 J	10,500,000	842,000	18,100,000 J,E	560,000	124,000	1,530,000	509,000	<37,214	302,000	14,250
C-14	C-14-A	IIA/IIB	0	09/15/10	131 J	<29.2 UJ	420 J	<72.4	920 J	<59.9 UJ	<100 UJ	242	98.6	<53.3	45.6	5.87
DC-22	DC-22-A	IIA/IIB	0	09/15/10	1010	<413	3310	<440	7990	405	<339	1300	1020	238	535	24.7
DC-23	DC-23-A	IIA/IIB	0	09/15/10	4060	<1546	13,900	<1109	26,200	<1135	<842 UJ	4340	2740	<536	1030	52.3
DC-52	DC-52-A	IIA/IIB	0	09/15/10	659 J	<59.3 UJ	2220	99.3	2990	104	<82.4	216	136	<50.5	41.7	5.13
B-1	B-1-A4[6]	IV	0	09/15/10	4600	<2171	14,600	<1746	25,200 J	<1546	<1647	1700	<1000	<677	<581	94.6
DC-25	DC-25-A	IV	0	09/15/10	77.9 J	<32.6 UJ	260	<46.8	389	<39.3	<45.1	<46.6	58.0	<34.8	28.5	2.81

Notes:
1. Depth = top of sample depth measured in feet below ground surface.
2. TEQ = Toxic Equivalent. Dioxin TEQ concentrations are calculated as the sum of the concentration of each dioxin-like PCB congener times the congener-specific toxic equivalency factor (TEF). The dioxin-like PCB congener concentrations in concrete and TEFs are listed above. Results below the reporting limit are represented by a value of one half the reporting limit in the dioxin TEQ concentration calculations.
3. WHO 2005 TEF = World Health Organization toxicity equivalency factors (TEF), released in 2005, but published in 2006 by Van den Berg, M. et al. ("The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds," Toxicological Sciences, 93[2]: 223-241, October).
4. -- = not applicable.
5. < = not detected at or above the reporting limit shown.
6. Samples B-1-A1, B-1-A4, and B-1-A5 were collected from the same area. Of the three samples, sample B-1-A4 was selected by SGS for analysis of PCB congeners.

Qualifiers:
E = concentration detected is greater than the upper calibration limit
J = estimated value
UJ = indicates the compound was analyzed but not detected and the sample detection limit is an estimated value.

TABLE E-4

DIOXIN-LIKE POLYCHLORINATED BIPHENYL (PCB) CONGENERS AND DIOXIN TEQs IN SOIL

Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Concentrations reported in picograms per gram (pg/g)

Sample Location	Sample ID	Phase Area	Sample Depth[1]	Sample Date	PCB 77	PCB 81	PCB 105	PCB 114	PCB 118	PCB 123	PCB 126	PCB 156, 157	PCB 167	PCB 169	PCB 189	Dioxin TEQ[2]
				WHO 2005 TEF[3]	0.0001	0.0003	0.00003	0.00003	0.00003	0.00003	0.1	0.00003	0.00003	0.03	0.00003	--[4]
#184	184-SS-01	I	1.7	09/13/10	4.18	<2.37[5]	36.6	<4.33	75.4 J	<3.59	<4.44	28.2	9.91	<4.28	2.82	0.29
#185	185-SS-01	I	2.4	09/13/10	5.74	<5.18	40.2	5.85	176 J	5.74	<2.72	6.58	<2.77	<2.39	1.25	0.18
#187	187-SS-01	I	1.8	09/14/10	<60.1	<55.0	2200 J	<216	2740 J	<227 UJ	<306 UJ	4760	1540	<139	176	17.7
#178	178-SS-01	IIA/IIB	0	09/13/10	11,900	<698	44,200 J,E	1060	75,200 J,E	8030	<925	7250	2450	<216	487	54.9
#181	181-SS-01	IIA/IIB	5.7	09/13/10	959	43.3	3620 J,E	253	5950 J,E	141	61.0	597	191	9.68	66.7	6.82
#182	182-SS-01	IIA/IIB	5.7	09/13/10	131,000 J,E	<15,391	565,000 J,E	25,400	1,030,000 J,E	22,400	<8373	157,000 J,E	56,300 J,E	<5493	23,100	573
#188	188-SS-01	IIA/IIB	2.3	09/13/10	26.5	<2.60	99.0	6.87	156 J	4.03	<2.16	7.68	2.73	<1.09	<1.12	0.14
#189	189-SS-01	IIA/IIB	4.7	09/14/10	41.9	<10.7	94.0	<8.38	198 J	<6.87	<8.89	8.55	<3.44	<3.30	<2.00	0.51
#189	189-SS-02	IIA/IIB	9.7	09/14/10	690	<87.7	33,900 J,E	1170	31,800 J,E	1040	<47.6	931	169	<11.5	6.57	4.71
#175	175-SS-01	IIIA	2.7	09/13/10	51,500	3130	246,000 J,E	18,700	320,000 J,E	7200	3450	20,900	5760	252	1210	377
#176	176-SS-01	IIIA	4.5	09/14/10	102,000 J,E	4230	322,000 J,E	23,000	446,000 J,E	13,400	3090	22,000	6090	103	937	349
#177	177-SS-01	IIIA	4.5	09/14/10	4080 J,E	<112	9320 J,E	503	14,200 J,E	368	85.5	464	127	<4.26	17.4	9.79
#180	180-SS-01	IIIA	4.5	09/14/10	1020	39.5	3570 J,E	232	6250 J,E	117	79.1 J	644	163	<11.4	36.1	8.53
#180	180-SS-02	IIIA	9.5	09/14/10	382	16.4	1140	84.1	2150 J	50.4	17.1	128	37.3	<2.64	6.30	1.90
#179	179-SS-01	IV	0.8	09/13/10	<1984	<1837	4220	<1834	6710	<1630	<1716	<1470	<1316	<1296	<967	106
#183	183-SS-01	IV	0.8	09/13/10	32,200 J,E	1160	111,000 J,E	6490	169,000 J,E	4620	1140	8740	2310	49.2	516	128
#186	186-SS-01	VI	2.0	09/14/10	15.4	<4.97	40.4 J	<4.58	60.9 J	<4.31	<4.32	5.27	1.97	<1.58	<1.17	0.25

Notes:
1. Depth = top of sample depth measured in feet below ground surface.
2. TEQ = Toxic Equivalent. Dioxin TEQ concentrations are calculated as the sum of the concentration of each dioxin-like PCB congener times the congener-specific toxic equivalency factor (TEF). The dioxin-like PCB congener concentrations in soil and TEFs are listed above. Results below the reporting limit are represented by a value of one half the reporting limit in the dioxin TEQ concentration calculations.
3. WHO 2005 TEF = World Health Organization toxicity equivalency factors (TEF), released in 2005, but published in 2006 by Van den Berg, M. et al. ("The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds," Toxicological Sciences, 93[2]: 223-241, October).
4. -- = not applicable.
5. < = not detected at or above the reporting limit shown.

Qualifiers:
E = concentration detected is greater than the upper calibration limit
J = estimated value
UJ = indicates the compound was analyzed but not detected and the sample detection limit is an estimated value.

TABLE E-5

DIOXIN TEQ VS. TOTAL PCBs (as Aroclors)

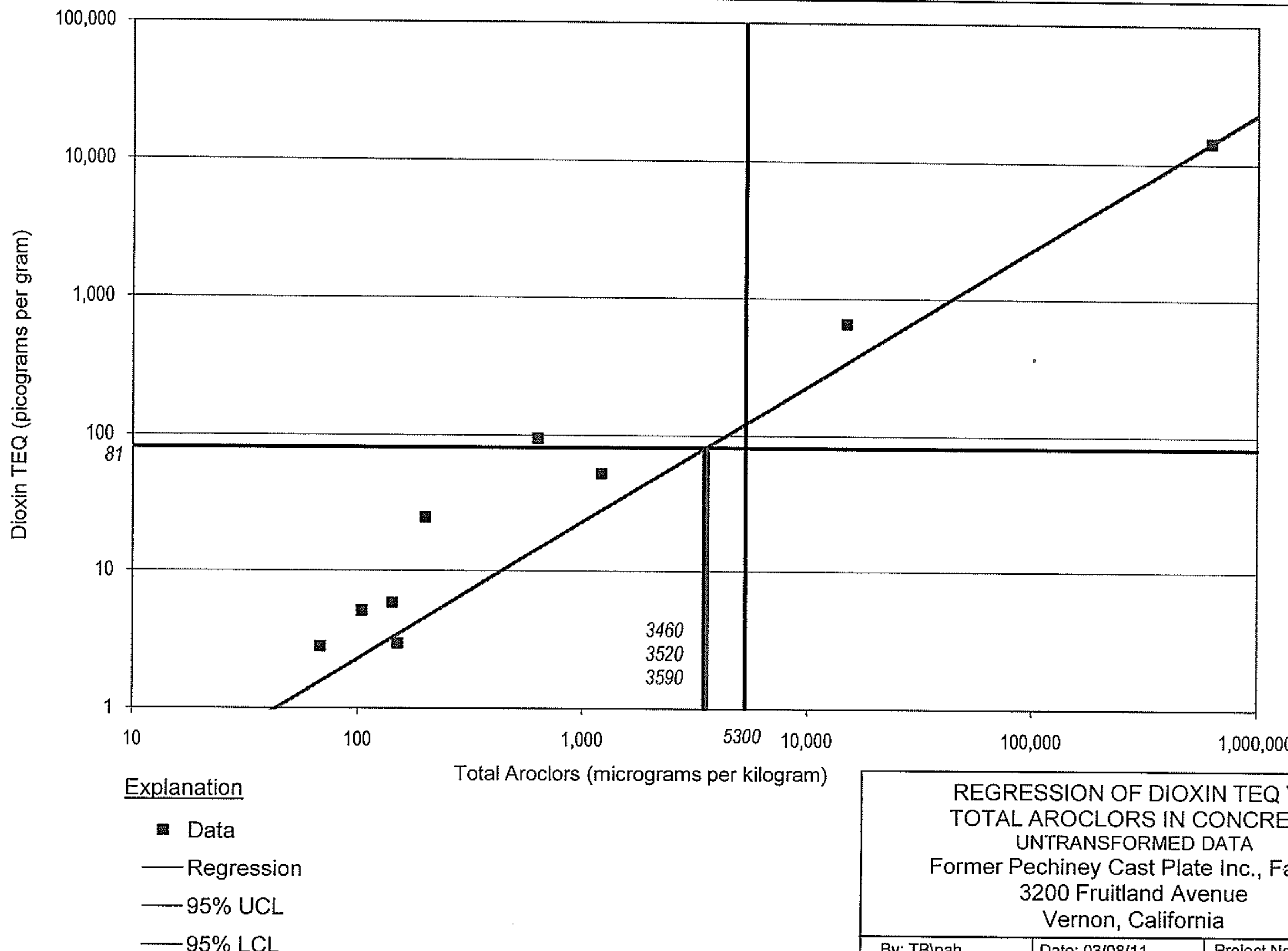
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Regression	Number of Data Points	Slope of Regression Line	Intercept of Regression Line	Ratio of Dioxin TEQ to Total Aroclor Concentration (pg/g)/(µg/kg)			Total Aroclor Concentration Corresponding to 81 pg/g Dioxin TEQ[4]			F-Statistic	Critical Value of F for α = 0.05	Statistical Significance of F-Statistic[5]
				95% UCL	Regression	95% LCL	95% UCL	Regression	95% LCL			
Untransfomed Data												
Concrete	9	0.0230[1]	0	0.0234	0.0230	0.0226	3,460	3,520	3,590	15437	5.32	5.77×10^{-13}
Soil	17	0.0107[1]	0	0.014	0.0107	0.00748	5,800	7,500	10,800	48.8	4.49	4.40×10^{-6}
Combined Soil and Concrete	26	0.0229[1]	0	0.0235	0.0229	0.0223	3,450	3,540	3,640	5874	4.24	3.33×10^{-30}
Log-Transformed Data												
Concrete	9	0.933[2]	-2.59[3]	NA	NA	NA	1,110	1,770	2,960	132	5.59	8.56×10^{-6}
Soil	17	1.08[2]	-4.62[3]	NA	NA	NA	1,850	4,380	20,100	22.9	4.54	2.49×10^{-4}
Combined Soil and Concrete	26	1.03[2]	-3.92[3]	NA	NA	NA	1,870	3,350	7,270	56.4	4.26	9.48×10^{-8}

Notes:
1. Slope of the regression line has the units picograms per gram per microgram per kilogram ([pg/g]\[µg/kg]).
2. Slope of the regression line in the log-transformed domain (dimensionless).
3. Intercept of the regression line in the log-transformed domain (dimensionless).
4. Concentration in micrograms per kilogram (µg/kg).
5. Smaller values of the statistical significance correspond to greater strength for the regression.

Abbreviation:
NA = not applicable. The ratio of dioxin TEQ to total Aroclors cannot be estimated using a regression of log-transformed data.

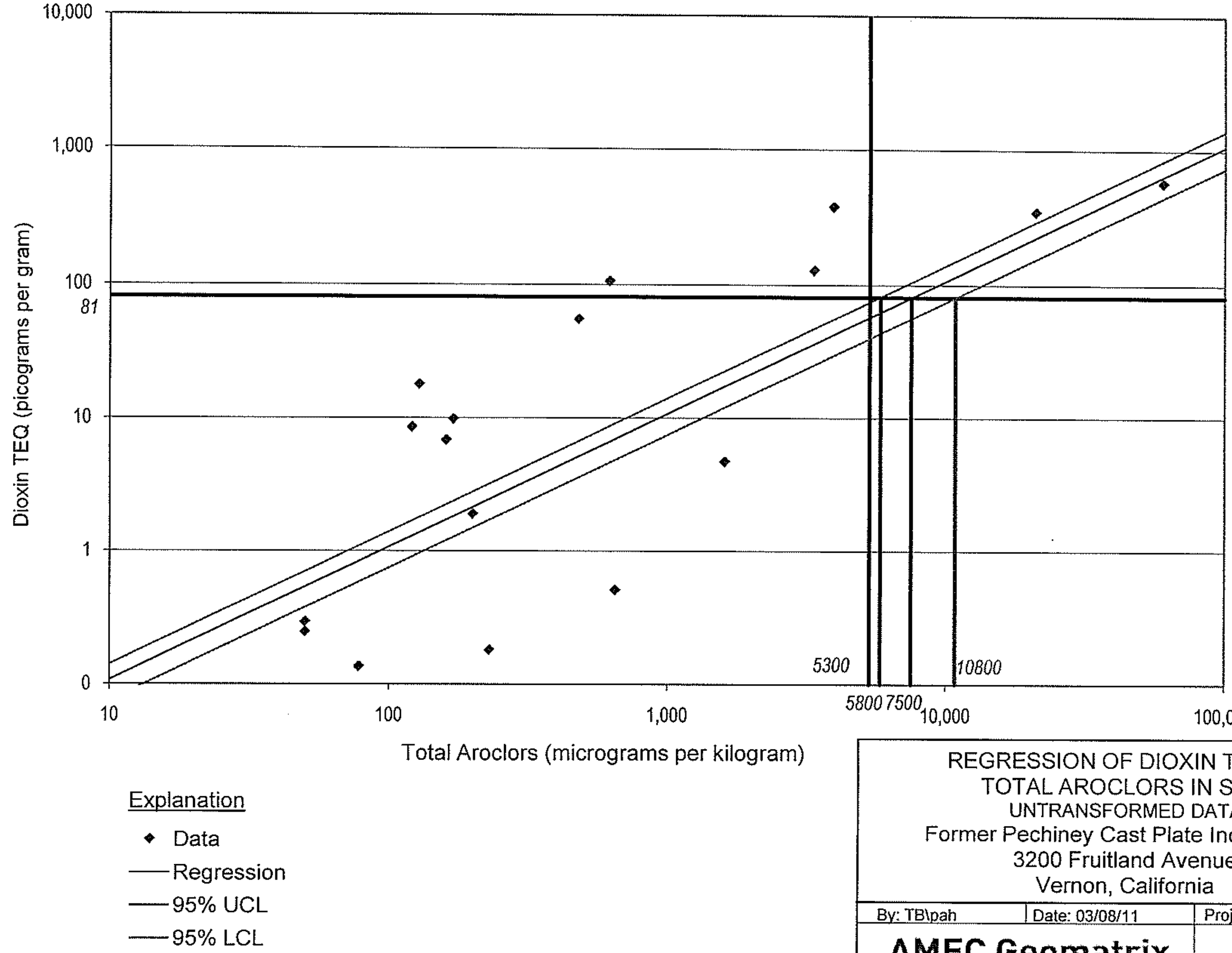
Y:\10627.003.0\acad\Reports_2011\FS_2011\Figure 3&6 DioxinTEQcalcs_concrete corrected 20101130.xlsFigure E-1 PCB Raw Data 3/7/2011



REGRESSION OF DIOXIN TEQ VS
TOTAL AROCLORS IN CONCRETE
UNTRANSFORMED DATA
Former Pechiney Cast Plate Inc., Facility
3200 Fruitland Avenue
Vernon, California

By: TB\pah	Date: 03/08/11	Project No.: 10627.003
AMEC Geomatrix		Figure **E-1**

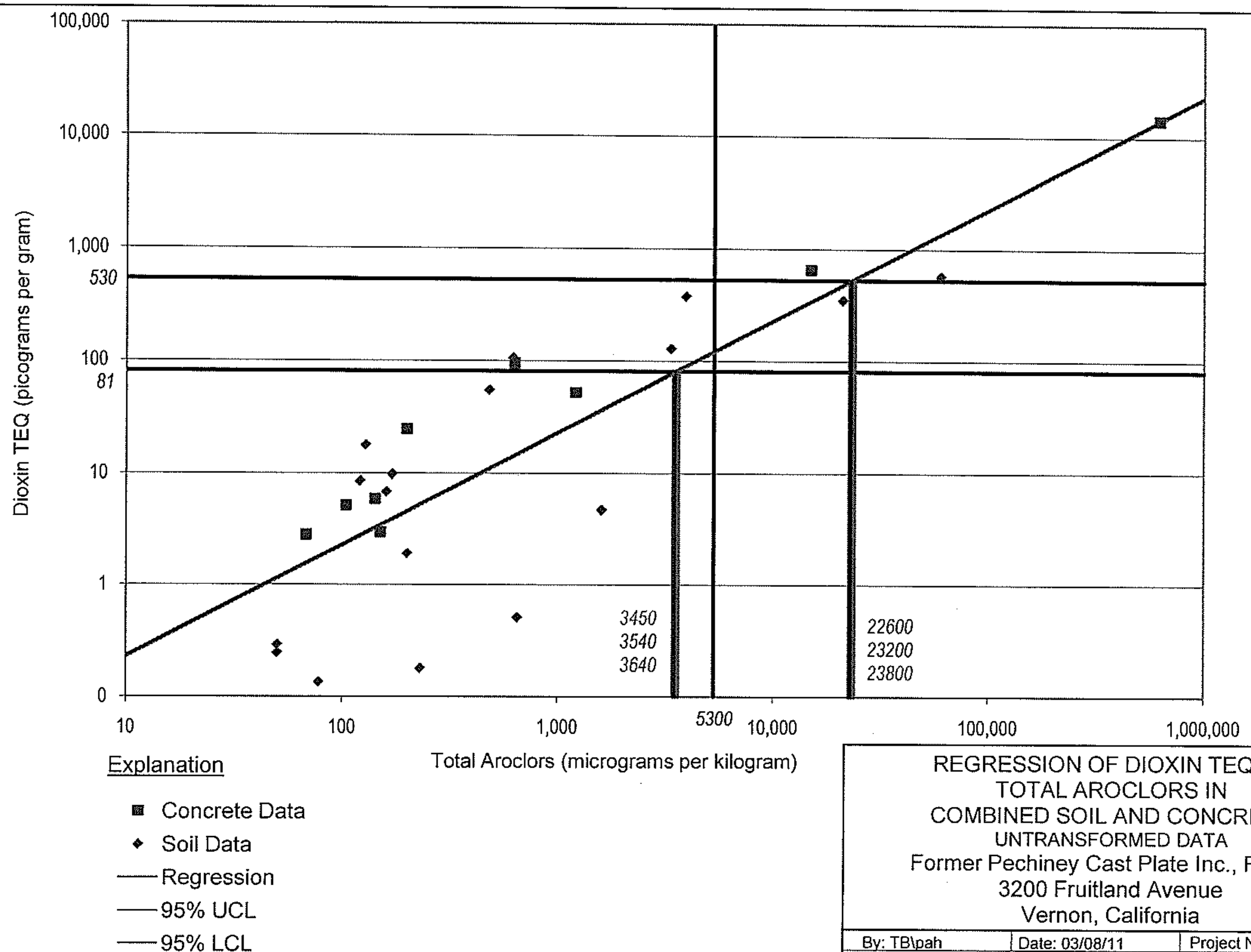
Y:\10627.003.0\acad\Reports_2011\FS_2011\Figure 4&7 DioxinTEQcalcs_soil corrected 20101130.xlsFigure E-2 PCB Raw Data 3/7/2011



REGRESSION OF DIOXIN TEQ VS
TOTAL AROCLORS IN SOIL
UNTRANSFORMED DATA
Former Pechiney Cast Plate Inc., Facility
3200 Fruitland Avenue
Vernon, California

By: TB\pah	Date: 03/08/11	Project No.: 10627.003
AMEC Geomatrix		Figure **E-2**

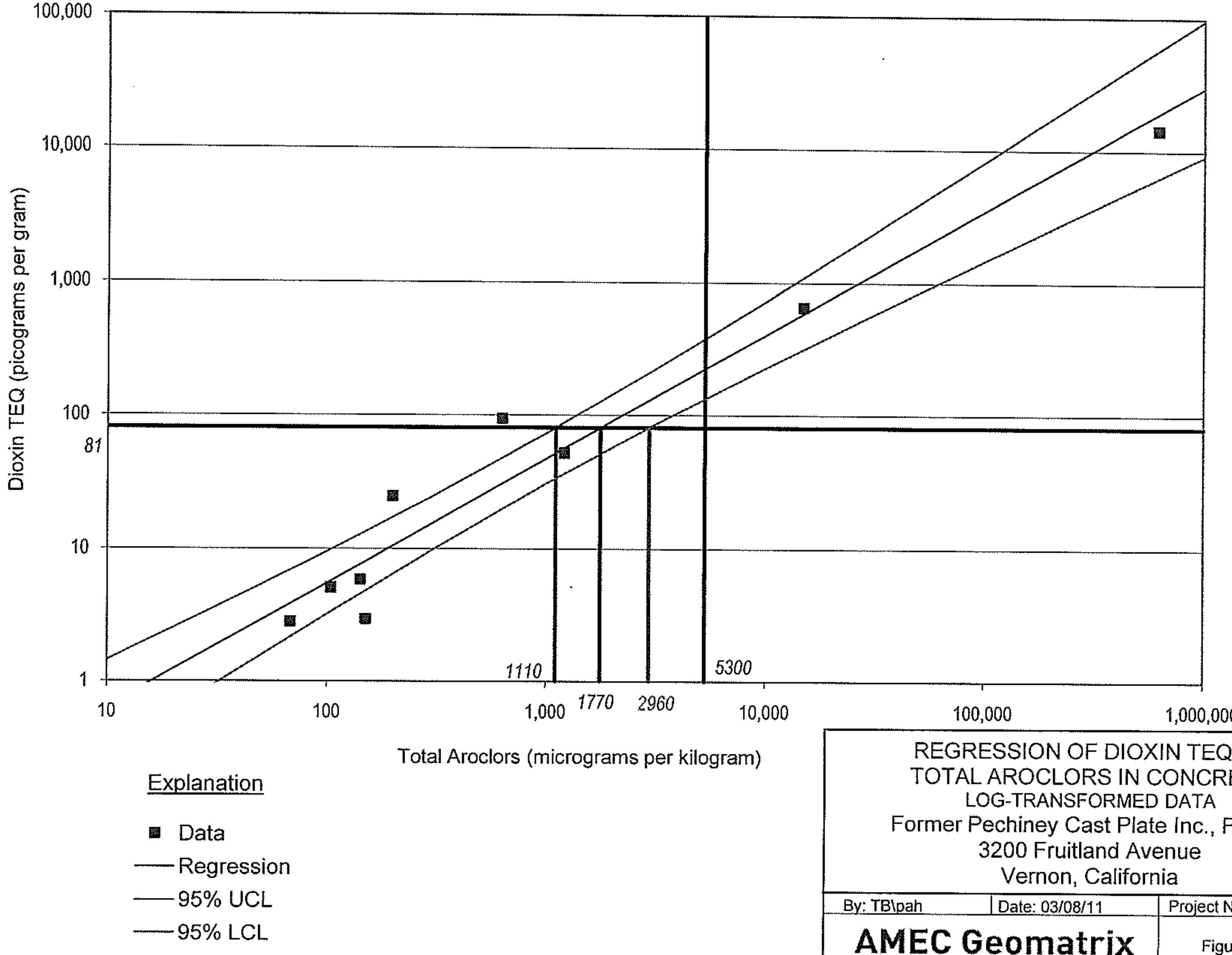
Y:\10627.003.0\acad\Reports_2011\FS_2011\Figures 5&8 DioxinTEQcalcs_combined soil & concrete 20101130.xlsFigure E-3 PCB Raw Data 3/7/2011



REGRESSION OF DIOXIN TEQ VS
TOTAL AROCLORS IN
COMBINED SOIL AND CONCRETE
UNTRANSFORMED DATA
Former Pechiney Cast Plate Inc., Facility
3200 Fruitland Avenue
Vernon, California

By: TB\pah	Date: 03/08/11	Project No.: 10627.003
AMEC Geomatrix		Figure **E-3**

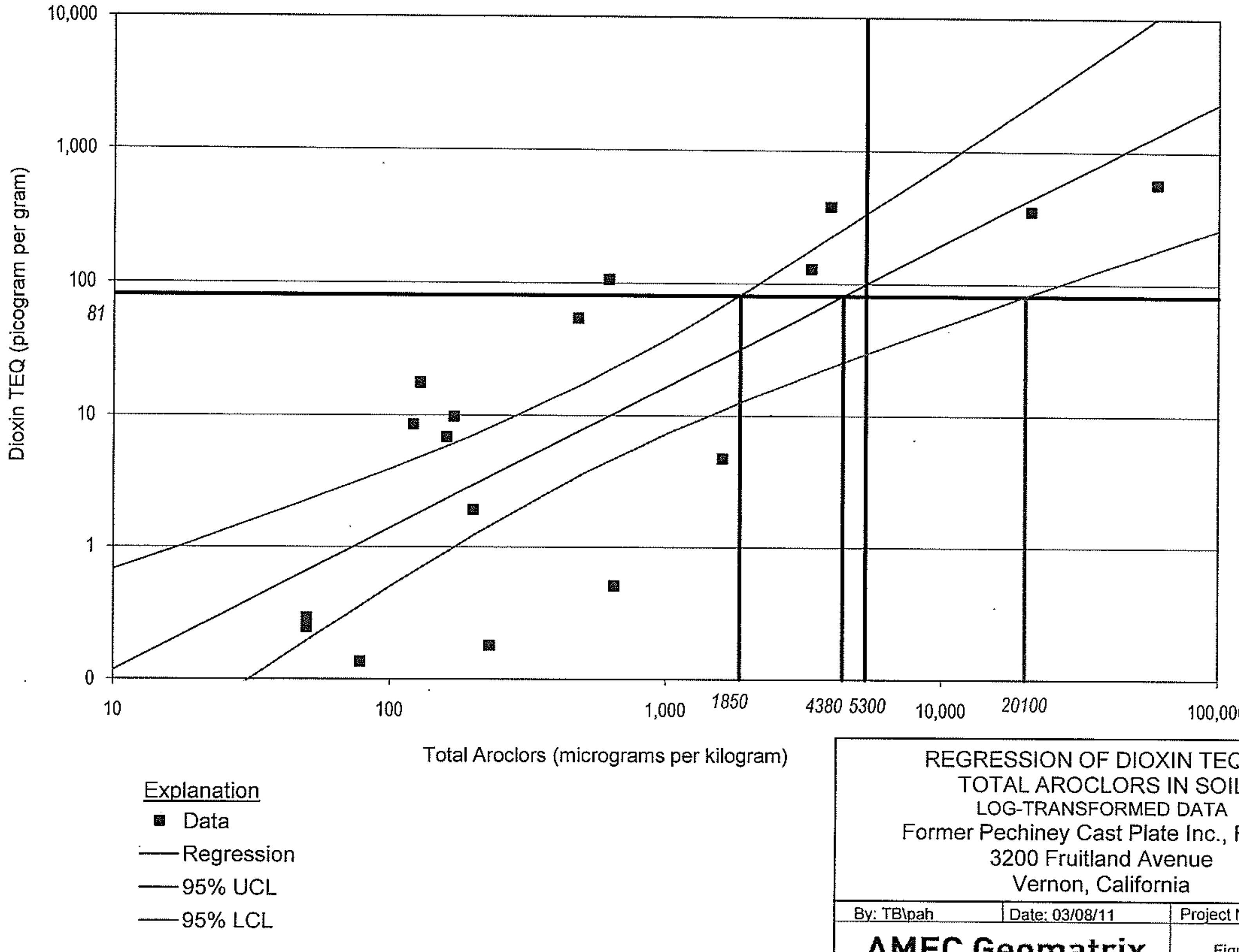
Y:\10627.003.0\acad\Reports_2011\FS_2011\Figure 3&6 DioxinTEQcalcs_concrete corrected 20101130.xlsFigure E-4 PCB Data LOG 3/7/2011



REGRESSION OF DIOXIN TEQ VS
TOTAL AROCLORS IN CONCRETE
LOG-TRANSFORMED DATA
Former Pechiney Cast Plate Inc., Facility
3200 Fruitland Avenue
Vernon, California

By: TB\pah	Date: 03/08/11	Project No.: 10627.003
AMEC Geomatrix		Figure E-4

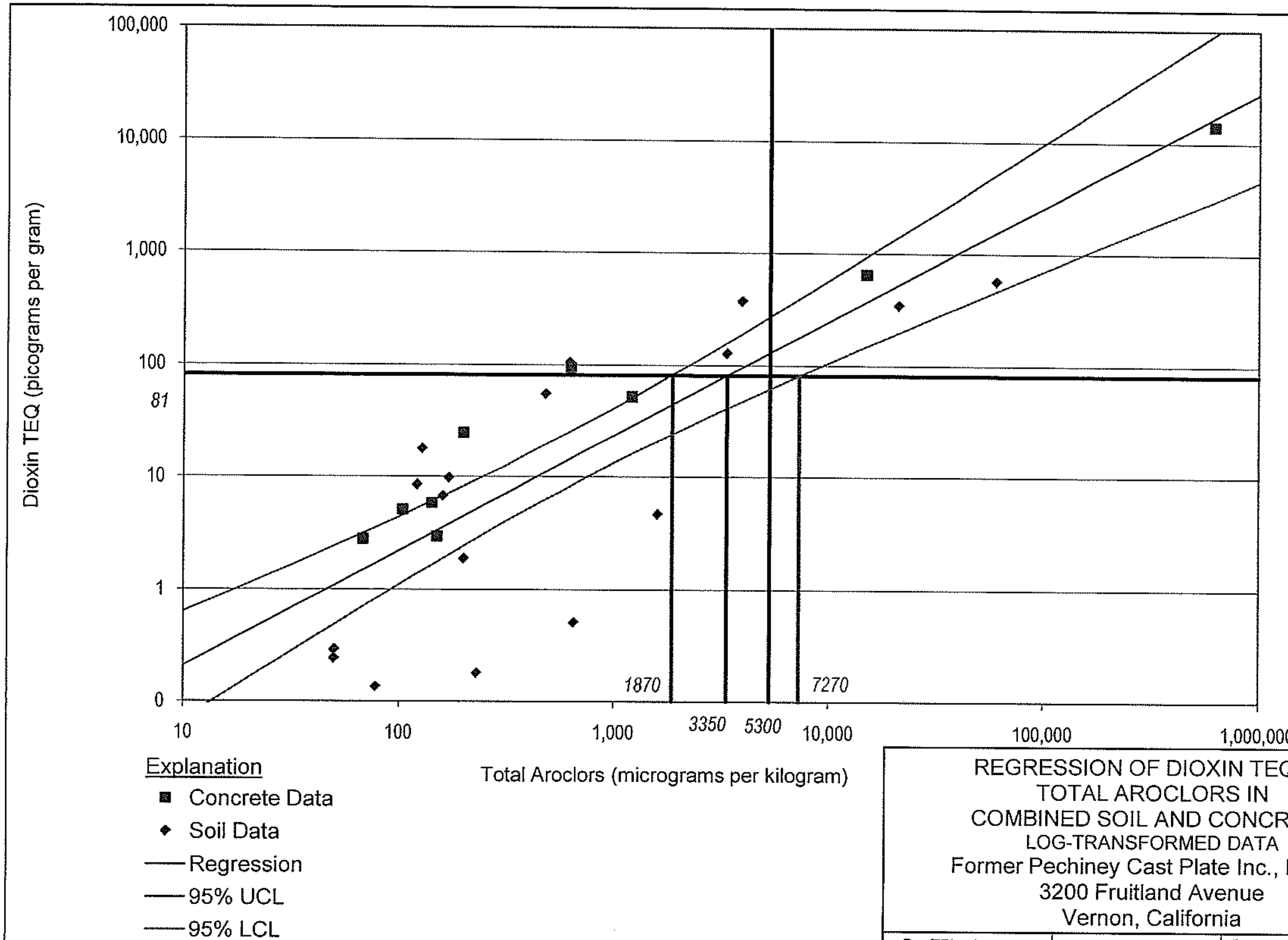
Y:\10627.003.0\acad\Reports_2011\FS_2011\Figure 4&7 DioxinTEQcalcs_soil corrected 20101130.xlsFigure E-5 PCB LOG Data 3/7/2011



REGRESSION OF DIOXIN TEQ VS
TOTAL AROCLORS IN SOIL
LOG-TRANSFORMED DATA
Former Pechiney Cast Plate Inc., Facility
3200 Fruitland Avenue
Vernon, California

By: TB\pah	Date: 03/08/11	Project No.: 10627.003
AMEC Geomatrix		Figure **E-5**

Y:\10627.003.0\acad\Reports_2011\FS_2011\Figures 5&8 DioxinTEQcalcs_combined soil & concrete 20101130.xlsFigure E-6 PCB Log Data 3/7/2011



REGRESSION OF DIOXIN TEQ VS
TOTAL AROCLORS IN
COMBINED SOIL AND CONCRETE
LOG-TRANSFORMED DATA
Former Pechiney Cast Plate Inc., Facility
3200 Fruitland Avenue
Vernon, California

By: TB\pah	Date: 03/08/11	Project No.: 10627.003
AMEC Geomatrix		Figure E-6

APPENDIX F

ProUCL Output, Combined Concrete and Soil Data

APPENDIX F
ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Concentrations in picograms per gram (pg/g)

Dioxin TEQ			
General Statistics			
Number of Valid Observations	26	Number of Distinct Observations	26
Raw Statistics		Log-transformed Statistics	
Minimum	0.14	Minimum of Log Data	-1.966
Maximum	14,250	Maximum of Log Data	9.565
Mean	643.6	Mean of log Data	2.668
Median	9.16	SD of log Data	2.895
SD	2,781		
Coefficient of Vàriation	4.321		
Skewness	5.065		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.241	Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.92	Shapiro Wilk Critical Value	0.92
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1,575	95% H-UCL	23,216
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2,188
95% Adjusted-CLT UCL (Chen-1995)	2,120	97.5% Chebyshev (MVUE) UCL	2,911
95% Modified-t UCL (Johnson-1978)	1,666	99% Chebyshev (MVUE) UCL	4,331
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.198	Data appear Lognormal at 5% Significance Level	
Theta Star	3,254		
MLE of Mean	643.6		
MLE of Standard Deviation	1,447		
nu star	10.28		
Approximate Chi Square Value (.05)	4.12	Nonparametric Statistics	
Adjusted Level of Significance	0.0398	95% CLT UCL	1,541
Adjusted Chi Square Value	3.864	95% Jackknife UCL	1,575
		95% Standard Bootstrap UCL	1,523
Anderson-Darling Test Statistic	2.399	95% Bootstrap-t UCL	13,204
Anderson-Darling 5% Critical Value	0.896	95% Hall's Bootstrap UCL	9,062
Kolmogorov-Smirnov Test Statistic	0.234	95% Percentile Bootstrap UCL	1,721
Kolmogorov-Smirnov 5% Critical Value	0.19	95% BCA Bootstrap UCL	2,328
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3,021
		97.5% Chebyshev(Mean, Sd) UCL	4,050
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	6,070
95% Approximate Gamma UCL	1,607		
95% Adjusted Gamma UCL	1,713		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	6,070

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Laci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

APPENDIX F
ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 77

General Statistics

Number of Valid Data	26	Number of Detected Data	24
Number of Distinct Detected Data	24	Number of Non-Detect Data	2
		Percent Non-Detects	7.69%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	4.18	Minimum Detected	1.43
Maximum Detected	2,730,000	Maximum Detected	14.82
Mean of Detected	133,148	Mean of Detected	7.191
SD of Detected	554,548	SD of Detected	3.493
Minimum Non-Detect	60.1	Minimum Non-Detect	4.096
Maximum Non-Detect	1,984	Maximum Non-Detect	7.593

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	16
For all methods (except KM, DL/2, and ROS Methods).		Number treated as Detected	10
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	61.54%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.252	Shapiro Wilk Test Statistic	0.976
5% Shapiro Wilk Critical Value	0.916	5% Shapiro Wilk Critical Value	0.916
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	122,945	Mean	7.034
SD	533,123	SD	3.432
95% DL/2 (t) UCL	301,538	95% H-Stat (DL/2) UCL	34,161,125

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	6.929
		SD in Log Scale	3.493
		Mean in Original Scale	122,912
		SD in Original Scale	533,131
		95% t UCL	301,508
		95% Percentile Bootstrap UCL	328,128
		95% BCA Bootstrap UCL	441,151

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.172	Data appear Lognormal at 5% Significance Level	
Theta Star	775,311		
nu star	8.243		

A-D Test Statistic	2.009	Nonparametric Statistics	
5% A-D Critical Value	0.909	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.909	Mean	122,920
5% K-S Critical Value	0.198	SD	522,776
Data not Gamma Distributed at 5% Significance Level		SE of Mean	104,730
		95% KM (t) UCL	301,814
Assuming Gamma Distribution		95% KM (z) UCL	295,185
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	301,515
Minimum	1.00E-12	95% KM (bootstrap t) UCL	2,284,932
Maximum	2,730,000	95% KM (BCA) UCL	340,969
Mean	122,906	95% KM (Percentile Bootstrap) UCL	325,858
Median	824.5	95% KM (Chebyshev) UCL	579,427
SD	533,133	97.5% KM (Chebyshev) UCL	776,958
k star	0.124	99% KM (Chebyshev) UCL	1,164,970
Theta star	991,365		
Nu star	6.447	**Potential UCLs to Use**	
AppChi2	1.872	**99% KM (Chebyshev) UCL**	**1164970**
95% Gamma Approximate UCL	423,199		
95% Adjusted Gamma UCL	462,165		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)
For additional insight, the user may want to consult a statistician

APPENDIX F

ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility

Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 81

General Statistics			
Number of Valid Data	26	Number of Detected Data	8
Number of Distinct Detected Data	8	Number of Non-Detect Data	18
		Percent Non-Detects	69.23%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	16.4	Minimum Detected	2.797
Maximum Detected	164,000	Maximum Detected	12.01
Mean of Detected	22,160	Mean of Detected	6.769
SD of Detected	57,344	SD of Detected	3.136
Minimum Non-Detect	2.37	Minimum Non-Detect	0.863
Maximum Non-Detect	15,391	Maximum Non-Detect	9.642
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	25
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	96.15%

Warning: There are only 8 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.448	Shapiro Wilk Test Statistic	0.916
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	7,251	Mean	4.633
SD	32,026	SD	3.068
95% DL/2 (t) UCL	17,979	95% H-Stat (DL/2) UCL	403,312
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	1.631
		SD in Log Scale	3.946
		Mean in Original Scale	6,819
		SD in Original Scale	32,086
		95% t UCL	17,568
		95% Percentile Bootstrap UCL	19,395
		95% BCA Bootstrap UCL	25,746
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.223	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	99,389		
nu star	3.567		
A-D Test Statistic	0.718	Nonparametric Statistics	
5% A-D Critical Value	0.827	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.827	Mean	6,860
5% K-S Critical Value	0.322	SD	31,455
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	6,595
		95% KM (t) UCL	18,126
Assuming Gamma Distribution		95% KM (z) UCL	17,708
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	17,594
Minimum	16.4	95% KM (bootstrap t) UCL	216,854
Maximum	164,000	95% KM (BCA) UCL	19,490
Mean	22,531	95% KM (Percentile Bootstrap) UCL	19,378
Median	22,207	95% KM (Chebyshev) UCL	35,608
SD	30,366	97.5% KM (Chebyshev) UCL	48,047
k star	0.571	99% KM (Chebyshev) UCL	72,481
Theta star	39,430		
Nu star	29.71	**Potential UCLs to Use**	
AppChi2	18.27	**95% KM (t) UCL**	**18126**
95% Gamma Approximate UCL	36,648		
95% Adjusted Gamma UCL	37,878		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX F

ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility

Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 105			
General Statistics			
Number of Valid Observations	26	Number of Distinct Observations	26
Raw Statistics		Log-transformed Statistics	
Minimum	36.6	Minimum of Log Data	3.6
Maximum	10,500,000	Maximum of Log Data	16.17
Mean	474,578	Mean of log Data	8.549
Median	3,595	SD of log Data	3.336
SD	2,050,390		
Coefficient of Variation	4.32		
Skewness	5.055		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.243	Shapiro Wilk Test Statistic	0.964
Shapiro Wilk Critical Value	0.92	Shapiro Wilk Critical Value	0.92
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1,161,446	95% H-UCL	89,003,719
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2,390,453
95% Adjusted-CLT UCL (Chen-1995)	1,561,942	97.5% Chebyshev (MVUE) UCL	3,199,645
95% Modified-t UCL (Johnson-1978)	1,227,884	99% Chebyshev (MVUE) UCL	4,789,144
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.174	Data appear Lognormal at 5% Significance Level	
Theta Star	2,733,529		
MLE of Mean	474,578		
MLE of Standard Deviation	1,138,978		
nu star	9.028		
Approximate Chi Square Value (.05)	3.344	Nonparametric Statistics	
Adjusted Level of Significance	0.0398	95% CLT UCL	1,135,997
Adjusted Chi Square Value	3.118	95% Jackknife UCL	1,161,446
		95% Standard Bootstrap UCL	1,113,593
Anderson-Darling Test Statistic	2.356	95% Bootstrap-t UCL	8,518,002
Anderson-Darling 5% Critical Value	0.909	95% Hall's Bootstrap UCL	6,241,994
Kolmogorov-Smirnov Test Statistic	0.246	95% Percentile Bootstrap UCL	1,271,181
Kolmogorov-Smirnov 5% Critical Value	0.191	95% BCA Bootstrap UCL	1,717,179
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2,227,354
		97.5% Chebyshev(Mean, Sd) UCL	2,985,782
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	4,475,566
95% Approximate Gamma UCL	1,281,303		
95% Adjusted Gamma UCL	1,373,928		
Potential UCL to Use		**Use 99% Chebyshev (Mean, Sd) UCL**	**4,475,566**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Laci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician

APPENDIX F

ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility

Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 114

General Statistics			
Number of Valid Data	26	Number of Detected Data	15
Number of Distinct Detected Data	15	Number of Non-Detect Data	11
		Percent Non-Detects	42.31%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	5.85	Minimum Detected	1.766
Maximum Detected	842,000	Maximum Detected	13.64
Mean of Detected	63,194	Mean of Detected	7.111
SD of Detected	215,716	SD of Detected	3.334
Minimum Non-Detect	4.33	Minimum Non-Detect	1.466
Maximum Non-Detect	1,834	Maximum Non-Detect	7.514
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	20
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	6
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	76.92%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.32	Shapiro Wilk Test Statistic	0.962
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	36,564	Mean	5.752
SD	164,513	SD	3.306
95% DL/2 (t) UCL	91,675	95% H-Stat (DL/2) UCL	4,560,308
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	4.559
		SD in Log Scale	4.06
		Mean in Original Scale	36,461
		SD in Original Scale	164,536
		95% t UCL	91,579
		95% Percentile Bootstrap UCL	101,009
		95% BCA Bootstrap UCL	136,276
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.195	Data appear Lognormal at 5% Significance Level	
Theta Star	323,801		
nu star	5.855		
A-D Test Statistic	1.183	Nonparametric Statistics	
5% A-D Critical Value	0.881	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.881	Mean	36,484
5% K-S Critical Value	0.246	SD	161,336
Data not Gamma Distributed at 5% Significance Level		SE of Mean	32,751
		95% KM (t) UCL	92,427
Assuming Gamma Distribution		95% KM (z) UCL	90,354
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	91,600
Minimum	1.00E-12	95% KM (bootstrap t) UCL	879,156
Maximum	842,000	95% KM (BCA) UCL	101,059
Mean	36,458	95% KM (Percentile Bootstrap) UCL	100,303
Median	45.49	95% KM (Chebyshev) UCL	179,242
SD	164,537	97.5% KM (Chebyshev) UCL	241,014
k star	0.0685	99% KM (Chebyshev) UCL	362,353
Theta star	531,862		
Nu star	3.564	**Potential UCLs to Use**	
AppChi2	0.558	**99% KM (Chebyshev) UCL**	**362,353**
95% Gamma Approximate UCL	233,052		
95% Adjusted Gamma UCL	265,800		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)
For additional insight, the user may want to consult a statistician

APPENDIX F

ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility

Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 118

General Statistics			
Number of Valid Observations	26	Number of Distinct Observations	26
Raw Statistics		Log-transformed Statistics	
Minimum	60.9	Minimum of Log Data	4.109
Maximum	18,100,000	Maximum of Log Data	16.71
Mean	806,877	Mean of log Data	9.078
Median	6,480	SD of log Data	3.239
SD	3,535,964		
Coefficient of Variation	4.382		
Skewness	5.059		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.24	Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical Value	0.92	Shapiro Wilk Critical Value	0.92
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1,991,403	95% H-UCL	86,929,610
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3,153,769
95% Adjusted-CLT UCL (Chen-1995)	2,682,620	97.5% Chebyshev (MVUE) UCL	4,216,636
95% Modified-t UCL (Johnson-1978)	2,106,065	99% Chebyshev (MVUE) UCL	6,304,432
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.174	Data appear Lognormal at 5% Significance Level	
Theta Star	4,648,693		
MLE of Mean	806,877		
MLE of Standard Deviation	1,936,730		
nu star	9.026		
Approximate Chi Square Value (.05)	3.342	Nonparametric Statistics	
Adjusted Level of Significance	0.0398	95% CLT UCL	1,947,516
Adjusted Chi Square Value	3.117	95% Jackknife UCL	1,991,403
		95% Standard Bootstrap UCL	1,962,157
Anderson-Darling Test Statistic	2.554	95% Bootstrap-t UCL	16,828,183
Anderson-Darling 5% Critical Value	0.909	95% Hall's Bootstrap UCL	13,161,327
Kolmogorov-Smirnov Test Statistic	0.266	95% Percentile Bootstrap UCL	2,178,341
Kolmogorov-Smirnov 5% Critical Value	0.191	95% BCA Bootstrap UCL	2,934,518
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3,829,597
		97.5% Chebyshev(Mean, Sd) UCL	5,137,531
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	7,706,713
95% Approximate Gamma UCL	2,178,811		
95% Adjusted Gamma UCL	2,336,344		
Potential UCL to Use		**Use 99% Chebyshev (Mean, Sd) UCL**	**7,706,713**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Laci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician

APPENDIX F
ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 123

General Statistics			
Number of Valid Data	26	Number of Detected Data	16
Number of Distinct Detected Data	16	Number of Non-Detect Data	10
		Percent Non-Detects	38.46%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	4.03	Minimum Detected	1.394
Maximum Detected	560,000	Maximum Detected	13.24
Mean of Detected	39,337	Mean of Detected	6.793
SD of Detected	138,995	SD of Detected	3.205
Minimum Non-Detect	3.59	Minimum Non-Detect	1.278
Maximum Non-Detect	1,630	Maximum Non-Detect	7.396
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	19
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	7
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	73.08%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.307	Shapiro Wilk Test Statistic	0.966
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	24,297	Mean	5.579
SD	109,399	SD	3.266
95% DL/2 (t) UCL	60,945	95% H-Stat (DL/2) UCL	3,061,277
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	4.666
		SD in Log Scale	3.821
		Mean in Original Scale	24,210
		SD in Original Scale	109,419
		95% t UCL	60,865
		95% Percentile Bootstrap UCL	66,693
		95% BCA Bootstrap UCL	89,230
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.2	Data appear Lognormal at 5% Significance Level	
Theta Star	196,503		
nu star	6.406		
A-D Test Statistic	1.276	Nonparametric Statistics	
5% A-D Critical Value	0.88	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.88	Mean	24,226
5% K-S Critical Value	0.238	SD	107,291
Data not Gamma Distributed at 5% Significance Level	.	SE of Mean	21,731
		95% KM (t) UCL	61,347
Assuming Gamma Distribution		95% KM (z) UCL	59,972
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	60,880
Minimum	1.00E-12	95% KM (bootstrap t) UCL	703,664
Maximum	560,000	95% KM (BCA) UCL	67,649
Mean	24,207	95% KM (Percentile Bootstrap) UCL	66,614
Median	77.2	95% KM (Chebyshev) UCL	118,952
SD	109,420	97.5% KM (Chebyshev) UCL	159,940
k star	0.0722	99% KM (Chebyshev) UCL	240,452
Theta star	335,183		
Nu star	3.755	**Potential UCLs to Use**	
AppChi2	0.628	**99% KM (Chebyshev) UCL**	**240,452**
95% Gamma Approximate UCL	144,867		
95% Adjusted Gamma UCL	164,570		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)
For additional insight, the user may want to consult a statistician

APPENDIX F

ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility

Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 126

General Statistics			
Number of Valid Data	26	Number of Detected Data	9
Number of Distinct Detected Data	9	Number of Non-Detect Data	17
		Percent Non-Detects	65.38%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	17.1	Minimum Detected	2.839
Maximum Detected	124,000	Maximum Detected	11.73
Mean of Detected	15,320	Mean of Detected	6.601
SD of Detected	40,807	SD of Detected	2.856
Minimum Non-Detect	2.16	Minimum Non-Detect	0.77
Maximum Non-Detect	8,373	Maximum Non-Detect	9.033
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	25
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	96.15%

Warning: There are only 9 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.432	Shapiro Wilk Test Statistic	0.934
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	5582	Mean	4.777
SD	24,202	SD	2.922
95% DL/2 (t) UCL	13,690	95% H-Stat (DL/2) UCL	218,795
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	2.457
		SD in Log Scale	3.562
		Mean in Original Scale	5,304
		SD in Original Scale	24,251
		95% t UCL	13,428
		95% Percentile Bootstrap UCL	14,724
		95% BCA Bootstrap UCL	19,991
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.231	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	66,179		
nu star	4.167		
A-D Test Statistic	0.8	Nonparametric Statistics	
5% A-D Critical Value	0.831	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.831	Mean	5,345
5% K-S Critical Value	0.305	SD	23,773
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	4,945
		95% KM (t) UCL	13,793
Assuming Gamma Distribution		95% KM (z) UCL	13,480
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	13,445
Minimum	17.1	95% KM (bootstrap t) UCL	144,401
Maximum	124,000	95% KM (BCA) UCL	14,865
Mean	15,185	95% KM (Percentile Bootstrap) UCL	14,931
Median	14,377	95% KM (Chebyshev) UCL	26,902
SD	23,115	97.5% KM (Chebyshev) UCL	36,230
k star	0.546	99% KM (Chebyshev) UCL	54,552
Theta star	27,826		
Nu star	28.380	**Potential UCLs to Use**	
AppChi2	17.220	**95% KM (t) UCL**	**13,793**
95% Gamma Approximate UCL	25,021		
95% Adjusted Gamma UCL	25,884		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility

Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 156, 157			
General Statistics			
Number of Valid Data	26	Number of Detected Data	24
Number of Distinct Detected Data	24	Number of Non-Detect Data	2
		Percent Non-Detects	7.69%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	5.27	Minimum Detected	1.662
Maximum Detected	1,530,000	Maximum Detected	14.24
Mean of Detected	75,255	Mean of Detected	6.828
SD of Detected	311,569	SD of Detected	3.305
Minimum Non-Detect	46.6	Minimum Non-Detect	3.842
Maximum Non-Detect	1,470	Maximum Non-Detect	7.293
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	16
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	10
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	61.54%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.258	Shapiro Wilk Test Statistic	0.971
5% Shapiro Wilk Critical Value	0.916	5% Shapiro Wilk Critical Value	0.916
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	69,495	Mean	6.677
SD	299,538	SD	3.251
95% DL/2 (t) UCL	169,838	95% H-Stat (DL/2) UCL	8,458,537
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	6.58
		SD in Log Scale	3.305
		Mean in Original Scale	69,471
		SD in Original Scale	299,544
		95% t UCL	169,816
		95% Percentile Bootstrap UCL	185,588
		95% BCA Bootstrap UCL	256,876
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.178	Data appear Lognormal at 5% Significance Level	
Theta Star	423,697		
nu star	8.525		
A-D Test Statistic	2.157	Nonparametric Statistics	
5% A-D Critical Value	0.906	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.906	Mean	69,478
5% K-S Critical Value	0.198	SD	293,725
Data not Gamma Distributed at 5% Significance Level		SE of Mean	58,843
		95% KM (t) UCL	169,991
Assuming Gamma Distribution		95% KM (z) UCL	166,267
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	169,823
Minimum	1.00E-12	95% KM (bootstrap t) UCL	2,211,825
Maximum	1,530,000	95% KM (BCA) UCL	186,483
Mean	69,466	95% KM (Percentile Bootstrap) UCL	184,427
Median	620.5	95% KM (Chebyshev) UCL	325,970
SD	299,545	97.5% KM (Chebyshev) UCL	436,954
k star	0.127	99% KM (Chebyshev) UCL	654,961
Theta star	547,397		
Nu star	6.599	**Potential UCLs to Use**	
AppChi2	1.953	**99% KM (Chebyshev) UCL**	**654,961**
95% Gamma Approximate UCL	234,691		
95% Adjusted Gamma UCL	255,934		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)
For additional insight, the user may want to consult a statistician

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ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 167			
General Statistics			
Number of Valid Data	26	Number of Detected Data	22
Number of Distinct Detected Data	22	Number of Non-Detect Data	4
		Percent Non-Detects	15.38%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	1.97	Minimum Detected	0.678
Maximum Detected	509,000	Maximum Detected	13.14
Mean of Detected	27,339	Mean of Detected	6.093
SD of Detected	108,249	SD of Detected	3.101
Minimum Non-Detect	2.77	Minimum Non-Detect	1.019
Maximum Non-Detect	1,316	Maximum Non-Detect	7.182
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	17
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	9
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	65.38%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.271	Shapiro Wilk Test Statistic	0.975
5% Shapiro Wilk Critical Value	0.911	5% Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	23,177	Mean	5.677
SD	99,710	SD	3.235
95% DL/2 (t) UCL	56,580	95% H-Stat (DL/2) UCL	2,846,963
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	5.5
		SD in Log Scale	3.236
		Mean in Original Scale	23,136
		SD in Original Scale	99,720
		95% t UCL	56,542
		95% Percentile Bootstrap UCL	62,018
		95% BCA Bootstrap UCL	98,833
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.187	Data appear Lognormal at 5% Significance Level	
Theta Star	146,345		
nu star	8.22		
A-D Test Statistic	2.161	Nonparametric Statistics	
5% A-D Critical Value	0.9	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.9	Mean	23,141
5% K-S Critical Value	0.206	SD	97,782
Data not Gamma Distributed at 5% Significance Level		SE of Mean	19,628
		95% KM (t) UCL	56,668
Assuming Gamma Distribution		95% KM (z) UCL	55,426
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	56,546
Minimum	1.00E-12	95% KM (bootstrap t) UCL	802,484
Maximum	509,000	95% KM (BCA) UCL	62,515
Mean	23,133	95% KM (Percentile Bootstrap) UCL	61,736
Median	149.5	95% KM (Chebyshev) UCL	108,697
SD	99,720	97.5% KM (Chebyshev) UCL	145,717
k star	0.105	99% KM (Chebyshev) UCL	218,436
Theta star	219,826		
Nu star	5.472	**Potential UCLs to Use**	
AppChi2	1.376	**99% KM (Chebyshev) UCL**	**218,436**
95% Gamma Approximate UCL	91,974		
95% Adjusted Gamma UCL	101,533		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)
For additional insight, the user may want to consult a statistician

APPENDIX F
ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 169

General Statistics

Number of Valid Data	26	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	21
		Percent Non-Detects	80.77%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	9.68	Minimum Detected	2.27
Maximum Detected	252	Maximum Detected	5.529
Mean of Detected	130.4	Mean of Detected	4.36
SD of Detected	109.9	SD of Detected	1.348
Minimum Non-Detect	1.09	Minimum Non-Detect	0.0862
Maximum Non-Detect	37,214	Maximum Non-Detect	10.52

Note: Data have multiple DLs - Use of KM Method is recommended	
Number treated as Non-Detect	26
For all methods (except KM, DL/2, and ROS Methods),	
Number treated as Detected	0
Observations < Largest ND are treated as NDs	
Single DL Non-Detect Percentage	100.00%

Warning: There are only 5 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.884	Shapiro Wilk Test Statistic	0.893
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	916.1	Mean	3.406
SD	3,648	SD	2.687
95% DL/2 (t) UCL	2,138	95% H-Stat (DL/2) UCL	17,836
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	1.409
		SD in Log Scale	1.613
		Mean in Original Scale	26.87
		SD in Original Scale	67.71
		95% t UCL	49.55
		95% Percentile Bootstrap UCL	49.97
		95% BCA Bootstrap UCL	58.59
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.58	Data appear Normal at 5% Significance Level	
Theta Star	224.6		
nu star	5.804		
A-D Test Statistic	0.309	Nonparametric Statistics	
5% A-D Critical Value	0.69	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.69	Mean	41.03
5% K-S Critical Value	0.364	SD	71.77
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	18.08
		95% KM (t) UCL	71.92
Assuming Gamma Distribution		95% KM (z) UCL	70.77
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	71.77
Minimum	1.00E-12	95% KM (bootstrap t) UCL	71.59
Maximum	252	95% KM (BCA) UCL	239
Mean	25.07	95% KM (Percentile Bootstrap) UCL	130
Median	1.00E-12	95% KM (Chebyshev) UCL	119.9
SD	68.39	97.5% KM (Chebyshev) UCL	154
k star	0.058	99% KM (Chebyshev) UCL	221
Theta star	433.7		
Nu star	3.006	**Potential UCLs to Use**	
AppChi2	0.374	95% KM (t) UCL	71.92
95% Gamma Approximate UCL	201.4	**95% KM (Percentile Bootstrap) UCL**	130
95% Adjusted Gamma UCL	232.1		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility

Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 189

General Statistics			
Number of Valid Data	26	Number of Detected Data	21
Number of Distinct Detected Data	21	Number of Non-Detect Data	5
		Percent Non-Detects	19.23%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	1.25	Minimum Detected	0.223
Maximum Detected	302,000	Maximum Detected	12.62
Mean of Detected	15,852	Mean of Detected	4.992
SD of Detected	65,754	SD of Detected	3.026
Minimum Non-Detect	1.12	Minimum Non-Detect	0.113
Maximum Non-Detect	967	Maximum Non-Detect	6.874
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	21
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	5
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	80.77%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.257	Shapiro Wilk Test Statistic	0.956
5% Shapiro Wilk Critical Value	0.908	5% Shapiro Wilk Critical Value	0.908
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	12,833	Mean	4.445
SD	59,150	SD	3.248
95% DL/2 (t) UCL	32,648	95% H-Stat (DL/2) UCL	892,290
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	4.088
		SD in Log Scale	3.454
		Mean in Original Scale	12,805
		SD in Original Scale	59,156
		95% t UCL	32,622
		95% Percentile Bootstrap UCL	35,279
		95% BCA Bootstrap UCL	48,458
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.171	Data appear Lognormal at 5% Significance Level	
Theta Star	92,757		
nu star	7.178		
A-D Test Statistic	2.829	Nonparametric Statistics	
5% A-D Critical Value	0.905	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.905	Mean	12,814
5% K-S Critical Value	0.211	SD	58,005
Data not Gamma Distributed at 5% Significance Level		SE of Mean	11,657
		95% KM (t) UCL	32,725
Assuming Gamma Distribution		95% KM (z) UCL	31,987
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	32,630
Minimum	1.25	95% KM (bootstrap t) UCL	1,302,238
Maximum	302,000	95% KM (BCA) UCL	36,079
Mean	16,192	95% KM (Percentile Bootstrap) UCL	35,874
Median	501.5	95% KM (Chebyshev) UCL	63,624
SD	58,816	97.5% KM (Chebyshev) UCL	85,610
k star	0.198	99% KM (Chebyshev) UCL	128,797
Theta star	81,586		
Nu star	10.32	**Potential UCLs to Use**	
AppChi2	4.143	**99% KM (Chebyshev) UCL**	**128,797**
95% Gamma Approximate UCL	40,336		
95% Adjusted Gamma UCL	42,993		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)
For additional insight, the user may want to consult a statistician

APPENDIX F
ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Concentrations in picograms per gram (pg/g)

Aroclor 1248

General Statistics			
Number of Valid Data	26	Number of Detected Data	21
Number of Distinct Detected Data	20	Number of Non-Detect Data	5
		Percent Non-Detects	19.23%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	38	Minimum Detected	3.638
Maximum Detected	390,000	Maximum Detected	12.87
Mean of Detected	21,116	Mean of Detected	6.128
SD of Detected	84,703	SD of Detected	2.518
Minimum Non-Detect	20	Minimum Non-Detect	2.996
Maximum Non-Detect	20	Maximum Non-Detect	2.996
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.263	Shapiro Wilk Test Statistic	0.861
5% Shapiro Wilk Critical Value	0.908	5% Shapiro Wilk Critical Value	0.908
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	17,057	Mean	5.392
SD	76,234	SD	2.727
95% DL/2 (t) UCL	42,595	95% H-Stat (DL/2) UCL	156,265
Maximum Likelihood Estimate (MLE) Method		Log ROS Method	
Mean	4,350	Mean in Log Scale	5
SD	84,774	SD in Log Scale	3.267
95% MLE (t) UCL	32,748	Mean in Original Scale	17,056
95% MLE (Tiku) UCL	31,838	SD in Original Scale	76,234
		95% t UCL	42,594
		95% Percentile Bootstrap UCL	46,674
		95% BCA Bootstrap UCL	62,297
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.197	Data do not follow a Discernable Distribution (0.05)	
Theta Star	107,012		
nu star	8.288		
A-D Test Statistic	3.179	Nonparametric Statistics	
5% A-D Critical Value	0.893	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.893	Mean	17,063
5% K-S Critical Value	0.21	SD	74,752
Data not Gamma Distributed at 5% Significance Level		SE of Mean	15,022
		95% KM (t) UCL	42,723
Assuming Gamma Distribution		95% KM (z) UCL	41,772
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	42,600
Minimum	1.00E-12	95% KM (bootstrap t) UCL	446,762
Maximum	390,000	95% KM (BCA) UCL	47,937
Mean	17,056	95% KM (Percentile Bootstrap) UCL	46,904
Median	130	95% KM (Chebyshev) UCL	82,543
SD	76,234	97.5% KM (Chebyshev) UCL	110,876
k star	0.0984	99% KM (Chebyshev) UCL	166,531
Theta star	173,317		
Nu star	5.117	**Potential UCLs to Use**	
AppChi2	1.207	**99% KM (Chebyshev) UCL**	**166,531**
95% Gamma Approximate UCL	72,326		
95% Adjusted Gamma UCL	80,226		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)
For additional insight, the user may want to consult a statistician

APPENDIX F
ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Concentrations in picograms per gram (pg/g)

Aroclor 1254

General Statistics			
Number of Valid Data	26	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	23
		Percent Non-Detects	88.46%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	56	Minimum Detected	4.025
Maximum Detected	19,000	Maximum Detected	9.852
Mean of Detected	7,119	Mean of Detected	7.206
SD of Detected	10,351	SD of Detected	2.95
Minimum Non-Detect	20	Minimum Non-Detect	2.996
Maximum Non-Detect	20,000	Maximum Non-Detect	9.903
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	26
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.837	Shapiro Wilk Test Statistic	0.975
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1,238	Mean	3.47
SD	4,131	SD	2.235
95% DL/2 (t) UCL	2,622	95% H-Stat (DL/2) UCL	2,786
Maximum Likelihood Estimate (MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-6.534
		SD in Log Scale	7.554
		Mean in Original Scale	821.6
		SD in Original Scale	3,735
		95% t UCL	2,073
		95% Percentile Bootstrap UCL	2,197
		95% BCA Bootstrap UCL	3,105
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	Data appear Normal at 5% Significance Level	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	Nonparametric Statistics	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	903.5
5% K-S Critical Value	N/A	SD	3,720
Data not Gamma Distributed at 5% Significance Level		SE of Mean	911.2
		95% KM (t) UCL	2,460
Assuming Gamma Distribution		95% KM (z) UCL	2,402
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2,601
Minimum	N/A	95% KM (bootstrap t) UCL	5,445
Maximum	N/A	95% KM (BCA) UCL	N/A
Mean	N/A	95% KM (Percentile Bootstrap) UCL	19,000
Median	N/A	95% KM (Chebyshev) UCL	4,875
SD	N/A	97.5% KM (Chebyshev) UCL	6,594
k star	N/A	99% KM (Chebyshev) UCL	9,970
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	**95% KM (t) UCL**	2,460
95% Gamma Approximate UCL	N/A	95% KM (Percentile Bootstrap) UCL	19,000
95% Adjusted Gamma UCL	N/A		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX F
ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Concentrations in picograms per gram (pg/g)

Aroclor 1260

General Statistics			
Number of Valid Data	26	Number of Detected Data	17
Number of Distinct Detected Data	17	Number of Non-Detect Data	9
		Percent Non-Detects	34.62%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	26	Minimum Detected	3.258
Maximum Detected	200,000	Maximum Detected	12.21
Mean of Detected	13,594	Mean of Detected	5.788
SD of Detected	48,437	SD of Detected	2.433
Minimum Non-Detect	20	Minimum Non-Detect	2.996
Maximum Non-Detect	100	Maximum Non-Detect	4.605
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	15
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	11
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	57.69%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.314	Shapiro Wilk Test Statistic	0.862
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	8,893	Mean	4.643
SD	39,306	SD	2.54
95% DL/2 (t) UCL	22,060	95% H-Stat (DL/2) UCL	31,690
Maximum Likelihood Estimate (MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	3.835
		SD in Log Scale	3.476
		Mean in Original Scale	8,889
		SD in Original Scale	39,307
		95% t UCL	22,057
		95% Percentile Bootstrap UCL	24,160
		95% BCA Bootstrap UCL	32,996
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.202	Data do not follow a Discernable Distribution (0.05)	
Theta Star	67293		
nu star	6.868		
A-D Test Statistic	2.825	Nonparametric Statistics	
5% A-D Critical Value	0.884	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.884	Mean	8,897
5% K-S Critical Value	0.232	SD	38,542
Data not Gamma Distributed at 5% Significance Level		SE of Mean	7,791
		95% KM (t) UCL	22,206
Assuming Gamma Distribution		95% KM (z) UCL	21,713
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	22,064
Minimum	1.00E-12	95% KM (bootstrap t) UCL	1,102,522
Maximum	200,000	95% KM (BCA) UCL	23,254
Mean	8,888	95% KM (Percentile Bootstrap) UCL	24,217
Median	42	95% KM (Chebyshev) UCL	42,859
SD	39,307	97.5% KM (Chebyshev) UCL	57,554
k star	0.077	99% KM (Chebyshev) UCL	86,419
Theta star	115,475		
Nu star	4.002	**Potential UCLs to Use**	
AppChi2	0.723	**99% KM (Chebyshev) UCL**	**86,419**
95% Gamma Approximate UCL	49,227		
95% Adjusted Gamma UCL	55,644		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)
For additional insight, the user may want to consult a statistician

APPENDIX G

Remedial Alternatives Cost Tables

Table G-1
Alternative #2
Excavation and Disposal of All COC-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Direct Capital Costs					
1	Mobilization/Demobilization	1	ls	$ 20,000	$ 20,000
2	Excavation Shoring	110,500	sqft	$ 35	$ 3,867,500
PCBs					
3	Excavate/Load	1,500	cy	$ 8	$ 12,000
4a	Transport and Dispose (PCB-Impacted Non-TSCA)	640	ton	$ 70	$ 44,800
4b	Transport and Dispose (TSCA >50 mg/kg, < 1000 mg/kg)	1,400	ton	$ 198	$ 277,200
4c	Transport and Dispose (TSCA > 1000 mg/kg)	200	ton	$ 295	$ 59,000
Metals					
5	Excavate/Stockpile/Load	70	cy	$ 8	$ 560
6a	Transport and Dispose - Non-Hazardous	95	ton	$ 44	$ 4,180
6b	Transport and Dispose Non-RCRA CA Hazardous	10	ton	$ 102	$ 1,020
VOCs and Stoddard Solvent					
7	Excavate/Stockpile/Load	159,200	cy	$ 8	$ 1,273,600
8a	Transport and Dispose Non-Hazardous	214,920	ton	$ 65	$ 13,969,800
8b	Transport and Dispose RCRA-Hazardous	23,880	ton	$ 134	$ 3,199,920
9	Stockpile and Confirmation Sampling	800	ea	$ 250	$ 200,000
10	Purchase and Import Fill	50,000	ton	$ 9	$ 450,000
11	Place and Compact Fill	40,000	ton	$ 9.25	$ 370,000
PCB-Impacted Concrete[6]					
12	Concrete Removal/Crush/Place (PCBs >1.0 mg/kg but <3.5 mg/kg)[7]	26,220	ft^3	$ 3	$ 78,660
13	Concrete Removal/Size/Load (PCBs >3.5 mg/kg but <50 mg/kg)	7,080	ft^3	$ 4	$ 28,320
14	Concrete Removal/Size/Load (PCBs >50 mg/kg)	2,020	ft^3	$ 4	$ 8,080
15	Stockpile and Confirmation Sampling	35	ea	$ 250	$ 8,830
16	Transport and Dispose (PCBs >3.5 mg/kg, but <50 mg/kg)	900	ton	$ 115	$ 103,500
17	Transport and Dispose (PCBs >50 mg/kg)	120	ton	$ 295	$ 35,400
18	Interim Cap	1	ls	$ 20,000	$ 20,000
Other					
19	Air Monitoring	1	ls	$ 20,000	$ 20,000
20	Health and Safety	1	ls	$ 20,000	$ 20,000
21	Other Non-Scheduled Contract Work	1	ls	$ 20,000	$ 20,000
				Direct Capital Total	$ 24,092,000

Table G-1
Alternative #2
Excavation and Disposal of All COC-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Indirect Capital Costs					
1	Construction Management	6%	of	$ 24,092,000	$ 1,445,520
				Indirect Capital Subtotal	$ 1,446,000
				Direct + Indirect Cost	$ 25,538,000
				Bid Contingency (15% estimated contractor costs)	$ 3,831,000
				Scope Contingency (15% estimated contractor costs)	$ 3,831,000
				Contingencies	$ 7,662,000
				Capital Total	**$ 33,200,000**

Notes/Assumptions:
1. Excavation costs include SCAQMD Rule 1166 Monitoring.
2. Excavation shoring cost only includes areas proposed to be excavated at depths of 10 feet bgs or greater.
3. Soil stockpile confirmation sampling rate at one sample per 200 cy; concrete confirmation sampling rate at one sample per 1,000 ft^2.
4. Excavation and disposal will commence at a rate of 500 cy per day.
5. Backfill to be comprised of crushed recycled aggregate obtained from on-site demolition and crushing of former concrete structures. Unit cost for placement and compaction also includes crushing. Additional Purchase and Import Fill includes compaction.
6. PCB-Impacted Concrete includes removal and disposal of all concrete impacted with PCBs greater than 1.0 mg/kg. Demolition and removal costs associated with foundations, footings, pits, sumps, and other subsurface structures are excluded.
7. Concrete Removal/Crush/Place (PCBs >1.0 mg/kg, but <3.5 mg/kg) includes crushing, placement, and compaction.
8. PCB-impacted soil and concrete will be profiled based on TSCA requirements and direct-loaded into waste transport trucks for disposal. Based on the TSCA requirements, 70% of PCB-impacted soil will be disposed of as TSCA (>50 mg/kg) and 30% as non-TSCA (<50 mg/kg).
9. 90% of Metals-impacted soil excavated will be disposed of as Non-Hazardous. 10% of Metals-impacted soil excavated will be disposed of as RCRA-Hazardous.
10. 90% of VOC-impacted soil excavated will be disposed of as Non-Hazardous. 10% of VOC-impacted soil excavated will be disposed of as RCRA-Hazardous.
11. Soil Conversion Factor: 1.5 tons/cy.
12. Concrete slab removal is based on an average concrete slab thickness of 12 inches.
13. Density of Concrete is 150 lbs/ft^3.
14. No cost included for institutional controls such as deed restrictions which will include legal and administrative fees.
15. No cost included for engineering controls such as future vapor barrier requirements.
16. Bid and Scope contingencies derived from "A Guide to Developing and Documenting Remedial Alternative Cost Estimates During the FS," EPA, 2000.
17. ls = lump sum price.
18. sqft = square feet.
19. cy = cubic yard.
20. ea = each.
21. ft^3 = cubic feet.

Table G-2
Alternative #3
Excavation and Disposal of Shallow COC-Impacted Soil
SVE for Shallow and Deep VOC-Impacted Soil
SVE and Bioventing for Shallow and Deep Stoddard Solvent-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Direct Capital Costs					
1	Mobilization/Demobilization	1	ls	$ 5,000	$ 5,000
2	Excavation Shoring	4,300	sqft	$ 35	$ 150,500
PCBs					
3	Excavate/Load	1,500	cy	$ 8	$ 12,000
4a	Transport and Dispose (PCBs >1 mg/kg, but <50 mg/kg)	640	ton	$ 70	$ 44,800
4b	Transport and Dispose (PCBs >50mg/kg, but <1,000 mg/kg)	1,400	ton	$ 198	$ 277,200
4c	Transport and Dispose (PCBs >1,000 mg/kg)	200	ton	$ 295	$ 59,000
Metals					
5	Excavate/Stockpile/Load	70	cy	$ 8	$ 560
6a	Transport and Dispose - Non-Hazardous	95	ton	$ 44	$ 4,180
6b	Transport and Dispose - Hazardous	10	ton	$ 102	$ 1,020
PCB-Impacted Concrete[6]					
7	Concrete Removal/Crush/Place (PCBs >1.0 mg/kg but <3.5 mg/kg)[7]	26,220	ft^3	$ 3	$ 78,660
8	Concrete Removal/Size/Load (PCBs >3.5 mg/kg but <50 mg/kg)	7,080	ft^3	$ 4	$ 28,320
9	Concrete Removal/Size/Load (PCBs >50 mg/kg)	2,020	ft^3	$ 4	$ 8,080
10	Stockpile and Confirmation Sampling	35	ea	$ 250	$ 8,750
11	Transport and Dispose (PCBs >3.5 mg/kg, but <50 mg/kg)	900	ton	$ 115	$ 103,500
12	Transport and Dispose (PCBs >50 mg/kg)	120	ton	$ 295	$ 35,400
13	Interim Cap	1	ls	$ 20,000	$ 20,000
VOCs SVE					
14	Site Preparation	1	ls	$ 5,000	$ 5,000
15	SVE Well and Probe Installation	23	ea	$ 6,000	$ 138,000
16	Well Head Completion, Valves, Surface Seal	23	ea	$ 1,000	$ 23,000
17	Treatment System Manifold, Valves, Controls	1	ls	$ 6,000	$ 6,000
18	Auto-Dialer Control and Instrumentation	1	ls	$ 5,000	$ 5,000
19	Vapor-Phase GAC Vessels [15]	1	ls	$ 18,000	$ 18,000
20	Electrical Panel/Supply	1	ls	$ 15,000	$ 15,000
21	Temporary Hose and Piping	2,000	lf	$ 10	$ 20,000
22	Compound Gravel Pad, Fence Installation, Gates	1	ea	$ 8,000	$ 8,000
23	Treatment System Installation and Start-Up	1	ls	$ 20,000	$ 20,000
24	Laboratory Analysis	1	ls	$ 10,000	$ 10,000
25	Health and Safety	1	ls	$ 10,000	$ 10,000
26	System Decommission	1	ls	$ 25,000	$ 25,000
27	Other Non-Scheduled Contract Work	1	ls	$ 10,000	$ 10,000
Stoddard Solvent SVE and Bioventing					
28	Mobilization/Demobilization	1	ls	$ 10,000	$ 10,000
29	Site Preparation	1	ls	$ 5,000	$ 5,000
30	BioVent Well and Probe Installation	19	ea	$ 6,000	$ 114,000
31	Well Head Completion, Valves, Surface Seal	19	ea	$ 1,000	$ 19,000
32	Treatment System Manifold, Valves, Controls	1	ls	$ 6,000	$ 6,000
33	Auto-Dialer Control and Instrumentation	1	ls	$ 5,000	$ 5,000
34	Vapor-Phase GAC Vessels	1	ls	$ 18,000	$ 18,000
35	Electrical Panel/Supply	1	ls	$ 50,000	$ 50,000
36	Below-Grade Piping	2,250	lf	$ 15	$ 33,750
37	Compound Pad, Fence Installation, Gates,	1	ea	$ 8,000	$ 8,000
38	Treatment System Installation and Start-Up	1	ls	$ 20,000	$ 20,000
39	Laboratory Analysis	1	ls	$ 10,000	$ 10,000
40	Health and Safety	1	ls	$ 10,000	$ 10,000
41	System Decommission	1	ls	$ 25,000	$ 25,000
42	Other Non-Scheduled Contract Work	1	ls	$ 10,000	$ 10,000
				Direct Capital Total	$ 1,494,000

Table G-2
Alternative #3
Excavation and Disposal of Shallow COC-Impacted Soil
SVE for Shallow and Deep VOC-Impacted Soil
SVE and Bioventing for Shallow and Deep Stoddard Solvent-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
	Indirect Capital Costs				
1	Permitting AQMD	5%	of	$ 313,000	$ 15,650
2	System Design	10%	of	$ 656,750	$ 65,675
3	Construction Management	6%	of	$ 1,494,000	$ 89,640
				Indirect Capital Subtotal	$ 171,000
				Direct + Indirect Cost	$ 1,665,000
				Bid Contingency (15% estimated contractor costs)	$ 250,000
				Scope Contingency (15% estimated contractor costs)	$ 250,000
				Contingencies	$ 500,000
				Capital Total	**$ 2,165,000**
Item No.	**Description**	**Estimated**	**Unit**	**Unit Cost**	**Estimated Cost**
	VOCs SVE and Stoddard Solvent SVE/Bioventing Annual Operation and Maintenance				
1	Equipment Rental	24	mths	$ 5,000	120,000
2	Operations & Maintenance	24	mths	$ 8,000	$ 192,000
3	Carbon Changeouts	32	ea	$ 3,000	$ 96,000
4	Electrical Fees	24	mths	$ 2,000	$ 48,000
5	Sampling & Analysis	24	mths	$ 2,000	$ 48,000
6	Production Water Disposal	24	mths	$ 4,000	$ 96,000
7	Project Management/Consultant support/Reports	24	mths	$ 4,000	$ 96,000
8	Health & Safety/Air Monitoring	24	mths	$ 1,000	$ 24,000
9	Miscellaneous	24	mths	$ 2,000	$ 48,000
10	DTSC Quarterly Status Report	4	ea	$ 10,000	$ 40,000
				Annual Operation and Maintenance Subtotal	**$ 808,000**
				Present Worth Factor (5%, 3 years)	2.72
				Present Worth of Operation and Maintenance	**$ 2,200,000**
	TOTAL CONSTRUCTION PLUS O&M FOR 3 YEARS				**$ 4,400,000**

Notes/Assumptions:
1. Excavation costs include SCAQMD Rule 1166 Monitoring.
2. Excavation shoring cost only includes areas proposed to be excavated at depths of 10 feet bgs or greater.
3. Soil stockpile confirmation sampling rate at one sample per 200 cy; concrete confirmation sampling rate at one sample per 1,000 ft.
4. Excavation and disposal will commence at a rate of 500 cy per day.
5. Backfill to be comprised of crushed recycled aggregate obtained from on-site demolition and crushing of former concrete structures.
Unit cost for placement and compaction also includes crushing. Additional Purchase and Import Fill includes compaction.
6. PCB-Impacted Concrete includes removal and disposal of all concrete impacted with PCBs greater than 1.0 mg/kg.
Demolition and removal costs associated with foundations, footings, pits, sumps, and other subsurface structures are excluded.
7. Concrete Removal/Crush/Place (PCBs >1.0 mg/kg, but <3.5 mg/kg) includes crushing, placement, and compaction.
8. PCB-impacted soil will be profiled based on TSCA requirements and direct-loaded into waste transport trucks for disposal.
Based on the TSCA requirements, 70% of PCB-impacted soil will be disposed of as TSCA (>50 mg/kg) and 30% as non-TSCA (<50 mg/k
9. 90% of Metals-impacted soil excavated will be disposed of as Non-Hazardous.
10% of Metals-impacted soil excavated will be disposed of as RCRA-Hazardous.
10. Soil Conversion Factor: 1.5 tons/cy.
11. Concrete slab removal is based on an average concrete slab thickness of 12 inches.
12. Assume 1,000 SCFM minimum for SVE system.
13. Total system operation costed for a period of one year; for purposes of O&M cost estimation, assume system run time of three years.
14. SVE = Soil Vapor Extraction.
15. Dual 1,000 pound vapor phase granular activated carbon (GAC) vessels for SVE system.
16. AQMD = Southern California Air Quality Management District.
17. No cost included for institutional controls such as deed restrictions which will include legal and administrative fees.
18. No cost included for engineering controls such as future vapor barrier requirements.
19. Bid and Scope contingencies derived from "A Guide to Developing and Documenting Remedial Alternative Cost Estimates During the FS," EPA, 2000.
20. ls = lump sum price.
21. sqft = square feet.
22. cy = cubic yard.
23. ea = each.
24. lf = linear feet.
25. mths = months.
26. ft^3 = cubic feet.

Table G-3
Alternative #4
In Situ Stabilization of Shallow PCB/Metals-Impacted Soil and Deep Stoddard Solvent-Impacted Soil
SVE for Shallow and Deep VOC-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Direct Capital Costs					
PCB, Metals, and Stoddard Solvent Stabilization					
1	Mobilization/Demobilization	1	ls	$ 100,000	$ 100,000
2	Site Preparation	1	ls	$ 10,000	$ 10,000
3	In-Situ Stabilization	48,000	cy	$ 135	$ 6,480,000
4	Confirmation Sampling	240	ea	$ 250	$ 60,000
5	Air Monitoring	1	ls	$ 15,000	$ 15,000
6	Excess Cuttings Disposal	14,400	ton	$ 70	$ 1,008,000
7	Health and Safety	1	ls	$ 10,000	$ 10,000
8	Other Non-Scheduled Contract Work	1	ls	$ 50,000	$ 50,000
PCB-Impacted Concrete[6]					
9	Concrete Removal/Crush/Place (PCBs >1.0 mg/kg but <3.5 mg/kg)[7]	26,220	ft^3	$ 3	$ 78,660
10	Concrete Removal/Size/Load (PCBs >3.5 mg/kg but <50 mg/kg)	7,080	ft^3	$ 4	$ 28,320
11	Concrete Removal/Size/Load	2,020	ft^3	$ 4	$ 8,080
12	Stockpile and Confirmation Sampling	35	ea	$ 250	$ 8,830
13	Transport and Dispose (PCBs >3.5 mg/kg, but <50 mg/kg)	900	ton	$ 115	$ 103,500
14	Transport and Dispose (PCBs >50 mg/kg)	120	ton	$ 295	$ 35,400
15	Interim Cap	1	ls	$ 20,000	$ 20,000
VOCs SVE					
16	Site Preparation	1	ls	$ 5,000	$ 5,000
17	SVE Well and Probe Installation	23	ea	$ 6,000	$ 138,000
18	Well Head Completion, Valves, Surface Seal	23	ea	$ 1,000	$ 23,000
19	Treatment System Manifold, Valves, Controls	1	ls	$ 6,000	$ 6,000
20	Auto-Dialer Control and Instrumentation	1	ls	$ 5,000	$ 5,000
21	Vapor-Phase GAC Vessels	1	ls	$ 18,000	$ 18,000
22	Electrical Panel/Supply	1	ls	$ 15,000	$ 15,000
23	Temporary Hose and Piping	2,000	lf	$ 10	$ 20,000
24	Compound Gravel Pad, Fence Installation, Gates	1	ea	$ 8,000	$ 8,000
25	Treatment System Installation and Start-Up	1	ls	$ 20,000	$ 20,000
26	Laboratory Analysis	1	ls	$ 10,000	$ 10,000
27	Health and Safety	1	ls	$ 10,000	$ 10,000
28	System Decommission	1	ls	$ 25,000	$ 25,000
29	Other Non-Scheduled Contract Work	1	ls	$ 10,000	$ 10,000
				Direct Capital Total	$ 8,329,000
Indirect Capital Costs					
1	Permitting AQMD	5%	of	$ 8,329,000	$ 416,450
2	System Design	10%	of	$ 8,329,000	$ 832,900
3	Construction Management	6%	of	$ 8,329,000	$ 499,740
				Indirect Capital Subtotal	$ 1,749,000
				Direct + Indirect Cost	$ 10,078,000
				Bid Contingency (15% estimated contractor costs)	$ 1,512,000
				Scope Contingency (15% estimated contractor costs)	$ 1,512,000
				Contingencies	$ 3,024,000
				Capital Total	$ 13,102,000

Table G-3
Alternative #4
In Situ Stabilization of Shallow PCB/Metals-Impacted Soil and Deep Stoddard Solvent-Impacted Soil
SVE for Shallow and Deep VOC-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete

Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Item No.	Description	Estimated	Unit	Unit Cost	Estimated Cost
	Annual Operation and Maintenance				
1	Equipment Rental	12	mths	$ 5,000	$ 60,000
2	Operations & Maintenance	12	mths	$ 8,000	$ 96,000
3	Carbon Changeouts	16	ea	$ 3,000	$ 48,000
4	Electrical Fees	12	mths	$ 2,000	$ 24,000
5	Sampling & Analysis	12	mths	$ 2,000	$ 24,000
6	Production Water Disposal	12	mths	$ 4,000	$ 48,000
7	Project Management/Consultant Support/Reports	12	mths	$ 4,000	$ 48,000
8	Health & Safety/Air Monitoring	12	mths	$ 1,000	$ 12,000
9	Miscellaneous	12	mths	$ 2,000	$ 24,000
10	DTSC Quarterly Status Report	4	ea	$ 10,000	$ 40,000
	Annual Operation and Maintenance Subtotal				**$ 424,000**
	Present Worth Factor (5%, 3 years)				2.72
	Present Worth of Operation and Maintenance				**$ 1,155,000**
	TOTAL CONSTRUCTION PLUS O&M FOR 3 YEARS				**$ 14,300,000**

Notes/Assumptions:

1. Mobilization includes Crawler-mounted large diameter augers.
2. Assume ~10 percent cement additive. Actual mix design would be performed during Design with necessary cement percentage based on leachability.
3. Stockpile confirmation sampling rate at one sample per 200 cubic yards.
4. Stabilization rate of 300 cubic yards per day.
5. PCB-Impacted Concrete includes removal and disposal of all concrete impacted with PCBs greater than 1.0 mg/kg. Demolition and removal costs associated with foundations, footings, pits, sumps, and other subsurface structures are excluded.
6. Concrete Removal/Crush/Place (PCBs >1.0 mg/kg, but <3.5 mg/kg) includes crushing, placement, and compaction.
7. No cost included for institutional controls such as deed restrictions which will include legal and administrative fees.
8. No cost included for engineering controls such as future vapor barrier requirements.
9. Cost assumes 20 percent of mixed volume requires off-site disposal.
10. Assume 1,000 SCFM minimum for SVE system.
11. Total system operation for a period of one year; for purposes of cost estimation, assumes system run time of three years.
12. SVE = Soil Vapor Extraction.
13. Dual 1,000 pound vapor phase granular activated carbon (GAC) vessels for SVE system.
14. AQMD = Southern California Air Quality Management District.
15. Soil Conversion Factor: 1.5 tons/cy.
16. Concrete Slab removal is based on an average concrete slab thickness of 12 inches.
17. Density of Concrete is 150 lbs/ft^3.
18. No cost included for institutional controls such as deed restrictions which will include legal and administrative fees.
19. No cost included for engineering controls such as future vapor barrier requirements.
20. Bid and Scope contingencies derived from "A Guide to Developing and Documenting Remedial Alternative Cost Estimates During the FS," EPA, 2000.
21. ls = lump sum price.
22. cy = cubic yard.
23. ea = each.
24. lf = linear feet.
25. mths = months.
26. ft^3 = cubic feet.

REMEDIAL ACTION PLAN

Former Pechiney Cast Plate, Inc., Facility

3200 Fruitland Avenue, Vernon, California

Prepared for:

Pechiney Cast Plate, Inc.

Prepared by:

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July 20, 2007
Revised July 23, 2008
Revised September 24, 2009
Revised July 27, 2011

Project No. 10627.003.0

REMEDIAL ACTION PLAN
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

July 20, 2007
Revised July 23, 2008
Revised September 24, 2009
Revised July 27, 2011
Project 10627.003.0

This report was prepared by the staff of AMEC Geomatrix, Inc., under the supervision of the Engineer and/or Geologist whose signatures appear hereon.

The findings, recommendations, specifications, or professional opinions are presented within the limits described by the client, in accordance with generally accepted professional engineering and geologic practice. No warranty is expressed or implied.

Linda Conlan, PG
Principal Geologist

Calvin H. Hardcastle, PE
Principal Engineer

DRAFT

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ACRONYMS AND ABBREVIATIONS

1,2-DCA	1,2-dichloroethane
Alcoa	Aluminum Company of America
AMEC	AMEC Geomatrix, Inc.
ASTM	ASTM International (formerly American Society for Testing and Materials)
BTEX	benzene, toluene, ethylbenzene, and total xylenes
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
CFR	Code of Federal Regulations
cfu/gm-dw	bacteria colony forming units per gram of soil dry weight
COC	chemical of concern
COPC	chemical of potential concern
Cr (VI)	hexavalent chromium
DAF20	Dilution Attenuation Factor of 20
DTSC	Department of Toxic Substances Control
ESA	Environmental Site Assessment
FS	Feasibility Study
Geomatrix	Geomatrix Consultants, Inc., and AMEC Geomatrix, Inc.
H&EC	City of Vernon Health & Environmental Control
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
ISR	in situ respiration
ISS	in situ stabilization
MCL	Maximum Contaminant Level

ACRONYMS AND ABBREVIATIONS
(Continued)

µg/L	micrograms per liter
mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
NCP	National Contingency Plan
O&M	Operation and Maintenance
OEC	Other Environmental Condition
OEHHA	Office of Environmental Health Hazard Assessment
Order	Imminent and Substantial Endangerment Determination and Consent Order
PCB	polychlorinated biphenyl
PCBNP	Polychlorinated Biphenyl Notification Plan
PCE	tetrachloroethene
Pechiney	Pechiney Cast Plate, Inc.
PID	photoionization detector
PPE	personal protective equipment
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
RAP	Remedial Action Plan
ROI	Radius of Influence
RBSL	Risk-Based Screening Level
REC	Recognized Environmental Condition
RWQCB	California Regional Water Quality Control Board, Los Angeles Region
SAP	Sampling and Analysis Plan
SCAQMD	South Coast Air Quality Management District
Site	Former Pechiney Cast Plate, Inc. Facility, 3200 Fruitland Avenue, Vernon, California
SSL	Soil Screening Level

ACRONYMS AND ABBREVIATIONS
(Continued)

SVE	Soil Vapor Extraction
SVOC	semi-volatile organic compound
SWPPP	Storm Water Pollution Prevention Plan
TCE	trichloroethene
TEPH	total extractable petroleum hydrocarbons
TMB	trimethylbenzene
TPH	total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TVPH	total volatile petroleum hydrocarbons
U.S. EPA	United States Environmental Protection Agency
UST	Underground Storage Tank
vGAC	vapor-phase Granular Activated Carbon
Vernon Facility	Former Pechiney Cast Plate, Inc. Facility, 3200 Fruitland Avenue, Vernon, California
VOC	volatile organic compound

DRAFT

REMEDIAL ACTION PLAN

Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

EXECUTIVE SUMMARY

AMEC Geomatrix, Inc. (AMEC), has prepared this Remedial Action Plan (RAP) on behalf of Pechiney Cast Plate, Inc. (Pechiney), for the former Pechiney facility (Vernon Facility or Site) located at 3200 Fruitland Avenue in Vernon, California (Figure 1).

Introduction and Purpose

Based on the information provided in the Feasibility Study (FS) (AMEC, 2011a), this RAP was prepared in accordance with Department of Toxic Substances Control (DTSC) guidance and policy for RAP development (DTSC policy #EO-95-007-PP), and pursuant to Health and Safety Code section 25356.1. This RAP provides the details and procedures for remediating polychlorinated biphenyl (PCB)-impacted concrete during demolition of below-grade features, and remediating impacted soil and soil vapor during and following below-grade demolition. On July 6, 2010, DTSC issued an Imminent and Substantial Endangerment Determination and Consent Order (Order) (DTSC, 2010) for the Site. DTSC has the final approval authority for the implementation of this site-wide RAP. However, pursuant to the Code of Federal Regulations (CFR), Title 40, Subchapter R, Toxic Substances Control Act, Part 761 (40 CFR 761), the United States Environmental Protection Agency (U.S. EPA) has approval authority for risk-based remediation of PCB releases and disposal of PCB remediation waste (soil and concrete). Pechiney will implement the RAP pursuant to the Order, and subject to DTSC's approval of the RAP and U.S. EPA approval of the PCB risk-based application referred to as the Polychlorinated Biphenyls Notification Plan (PCBNP) (AMEC, 2009) for the Site. On July 2, 2010, U.S. EPA issued a conditional approval letter regarding the PCBNP, which outlined requirements for additional PCB sampling and submission of additional information. In the conditional approval letter, U.S. EPA also deferred the approval of the PCB remediation goals until the additional PCB sampling results and information was submitted to U.S. EPA. The results of the additional sampling were submitted to U.S. EPA for review on December 29, 2010. U.S. EPA's conditional approval of the PCB remediation goals was granted on July 1, 2011.

This RAP was revised to address additional comments made by DTSC to the September 2009 draft RAP, and additional requirements imposed by U.S. EPA regarding PCBs.

Site History

The Site is comprised of approximately 26.9 acres and was formerly occupied by approximately 600,000 square feet of building area. Manufacturing operations at the Site began in approximately 1937 and included production of high-precision cast aluminum plates. As part of their manufacturing operations, Aluminum Company of America (Alcoa; original Site owner) used fuels and Stoddard solvent, both of which were stored in underground storage tanks. Stoddard solvent was used during the aluminum manufacturing process. Alcoa also operated processes that required lubricating oils and generated hazardous waste that was stored at various locations throughout the Site.

In 1998, Alcoa sold the western portion of the facility (3200 Fruitland Avenue) to Century Aluminum Company. In 1999, Pechiney purchased the Site, and subsequently closed the Vernon facility in late 2005.

Previous Investigations, Chemicals of Concern, and Removal Actions

Previous remedial investigations were conducted at the Site for soil, soil vapor, groundwater, and building materials. During these investigations, chemicals of concern (COCs) were identified at the Site as described below.

- Soil impacted with petroleum hydrocarbons (including Stoddard solvent compounds), metals, PCBs, and volatile organic compounds (VOCs).
- Soil vapor impacted with Stoddard solvent compounds and VOCs.
- Groundwater (at a depth of 150 feet) impacted with chlorinated VOCs.
- Building concrete slabs impacted with PCBs.

Prior to 1999, Alcoa investigated subsurface conditions and conducted limited remediation in both the eastern and western portions of its facility as part of their efforts to seek closure of its City of Vernon Health & Environmental Control hazardous materials permit. Alcoa's activities are described in Section 3.0 of this document.

As part of the aboveground demolition work completed in November 2006 by Pechiney, the above-ground features, including the former manufacturing facilities, were demolished leaving the concrete floor slab in place; and the debris was transported off site for disposal or recycling.

Summary of Site Risks

The preferred remedial alternatives discussed in this RAP focus on mitigating principal risk threats posed by remaining PCB-impacted concrete, surface and shallow COC-impacted soil, deeper soil impacted by Stoddard solvent, and deeper soil impacted by VOCs. Implementation of the RAP will reduce the potential for risks to human health due to exposure to shallow soil containing COCs, and reduce the potential impacts to groundwater from exposure to deeper COC-impacted soil.

The RAP also provides materials management practices that will be implemented during below-grade demolition, and excavation and removal of non-COC-impacted concrete and soil at the Site.

Remedy Evaluation Process

The Health and Safety Code section 25356.1(d) requires that remedy evaluations be based on requirements contained in the National Contingency Plan (NCP), 40 CFR 300.430. The NCP identifies evaluation criteria (also known as balancing or evaluation criteria) to be used in the development and scoping of remedial alternatives to provide a basis for comparison using additional, more detailed criteria, referred to as evaluation criteria. The criteria include those developed by the U.S. EPA in NCP 40 CFR 300.430(a)(1)(iii) and as modified by the State of California. All nine balancing criteria (including Threshold Criteria, Primary Balancing Criteria, and Modifying Criteria) are evaluated in the FS and described in this RAP.

The following technologies were previously evaluated in the FS and retained for additional detailed evaluation.

- No action.
- Excavation and removal followed by landfill disposal for surface and shallow COC-impacted soil and deep VOC-impacted soil.
- In situ stabilization of shallow metals-impacted soil, Stoddard solvent-impacted soil, and PCB-impacted soil.
- Soil vapor extraction (SVE) for shallow and deep VOC-impacted soil.
- SVE and bioventing for shallow and deep Stoddard solvent-impacted soil.
- Demolition and off-site disposal of PCB-impacted concrete.

These technologies were combined in the FS into potential alternatives considered for mitigating COC-impacted areas at the Site, which are discussed further in Section 6.2 of this document.

Alternatives Considered

The alternatives evaluated in the FS are presented below.

Alternative 1
Alternative 1 defined as "No Action" is included for evaluation pursuant to NCP 40 CFR 300.430(e)(6) and retained for comparison purposes. In this alternative, no below-grade demolition or soil remediation would be performed. Based on the findings described in the FS, a "No Action" alternative is not acceptable for this Site.

Alternative 2
Alternative 2 consists of excavation and off-site disposal of both shallow and deep COC-impacted soil (metals, PCBs, Stoddard solvent, and VOCs) to depths of approximately 8 feet below ground surface (bgs) for metals, 12 feet bgs for PCBs, and 45 to 50 feet bgs for VOCs and Stoddard solvent, respectively. Excavation will require installation of shoring for sidewall stability and safety during soil removal. This alternative also consists of demolition and landfill disposal of PCB-impacted concrete slabs containing PCB concentrations greater than 3.5 milligrams per kilogram (mg/kg). In addition, PCB-impacted concrete (greater than 1.0 mg/kg and less than 3.5 mg/kg) would be crushed and deposited on site as restricted fill material (i.e., on site disposal) and covered with an interim cap consisting of a visual identifier layer and a minimum of 12 inches of clean, crushed concrete (unrestricted fill material). Non-PCB-impacted concrete (less than or equal to 1.0 mg/kg) would be crushed and reused on site as unrestricted fill material. A land use covenant that incorporates an operation and maintenance (O&M) plan and soil management plan would also be included in this alternative.

Alternative 3
Alternative 3 consists of excavation and off-site disposal of shallow COC-impacted soil (PCBs and metals) to depths of approximately 15 feet bgs. Shallow (up to 50 feet bgs) and deep (up to 90 feet bgs) VOC-impacted soil would be mitigated using SVE. Shallow (up to 50 feet bgs) Stoddard solvent-impacted soil would be mitigated using sequential treatment consisting initially of SVE, followed by longer term bioventing. Deeper soils (at depths greater than 15 feet) impacted with PCBs above the remediation goal would be left in place and covered with a physical barrier at depth. The physical barrier would consist of 6 inches of cement concrete. This alternative also consists of demolition and landfill disposal of PCB-impacted concrete slabs containing PCB concentrations greater than 3.5 mg/kg. In addition, PCB-impacted concrete (greater than 1.0 mg/kg and less than 3.5 mg/kg) would be crushed and deposited on site as restricted fill material (i.e., on-site disposal) and covered with an interim cap consisting of a visual identifier layer and a minimum of 12 inches of clean, crushed concrete (unrestricted fill material). Non-PCB-impacted concrete (less than or equal to 1.0 mg/kg) would be crushed

and reused on site as unrestricted fill material. A land use covenant that incorporates an O&M plan and soil management plan would also be included in this alternative.

Alternative 4

Alternative 4 consists of in situ stabilization of shallow PCB- and metals-impacted soil and deep Stoddard solvent-impacted soil, using a cement-based additive to depths of approximately 15 feet bgs for PCB- and metals-impacted soil and approximately 50 feet for Stoddard solvent-impacted soil. Shallow (up to 50 feet bgs) and deep (up to 90 feet bgs) VOC-impacted soil would be mitigated using SVE. This alternative also consists of demolition and landfill disposal of PCB-impacted concrete slabs containing PCB concentrations greater than 3.5 mg/kg. PCB-impacted concrete (greater than 1.0 mg/kg and less than 3.5 mg/kg) would be crushed and deposited on site as restricted fill material (i.e., on-site disposal) and covered with an interim cap consisting of a visual identifier layer and a minimum of 12 inches of clean, crushed concrete (unrestricted fill material). Non-PCB-impacted concrete (less than or equal to 1.0 mg/kg) would be crushed and reused on site as unrestricted fill material. A land use covenant that incorporates an O&M plan and soil management plan would also be included in this alternative.

Preferred Remedial Alternative

Alternative 3 was selected as the preferred remedial alternative because Alternative 3 meets the balancing criteria discussed above, as required by Health and Safety Code Section 25356.1(d) and the NCP, and will not require extensive soil excavation and off-site disposal, and COC-impacted soil will be mitigated to reduce COC concentrations to levels below risk-based remediation goals. Alternative 3 is preferred over Alternative 2 because Alternative 3 provides a reduction of toxicity, mobility, and volume of COC-impacted soil by treatment compared to landfill disposal. Alternative 3 is preferred over Alternative 4 because Alternative 3 will reduce the toxicity, mobility, and volume of COC-impacted soil to a greater extent than Alternative 4. Alternative 3 consists of limited soil excavation and disposal and SVE and bioventing in a balanced mitigation strategy that is cost-effective, minimally invasive, less disruptive to the local community, and protective of human health and the environment. The preferred alternative also includes a land use covenant that incorporates an O&M plan and a soil management plan.

Community Involvement

The objective of the community involvement program is to inform the community of the progress of demolition and remediation work and to effectively respond to health, environment, and safety concerns and questions. The community involvement program will be consistent with the Comprehensive Environmental Response, Compensation and Liability Act as implemented by the NCP 40 CFR 300.430(c)(1). The purpose of the community involvement plan as stated by the NCP 40 CFR 300.430(c)(2)(ii)(A), is to "ensure the public appropriate opportunities for involvement in a wide variety of Site-related decisions, including Site analysis and characterization, alternatives analysis, and selection of remedy; and to determine, based on community interviews, appropriate activities to ensure such public involvement."

Objectives of the community involvement program include:

- soliciting input from the community on concerns regarding the remedial activities;
- establishing effective communication between the community, Pechiney, and DTSC;
- informing the community about progress of the remedial activities; and
- providing opportunities for the community to participate and comment on the proposed remedial activities.

Prior to implementation of the RAP, DTSC will expand its outreach and distribute an information fact sheet to businesses and residents surrounding the Site and to other interested stakeholders. This fact sheet will include information about the Site, remedial activities, and project contacts. Additionally, a local information repository will be established to make documents and other information available to the public and a Site mailing list will be developed.

This RAP will be made available to the public for a comment period of at least 30 days. DTSC will respond to any comments received during the public comment period and will provide a timely opportunity for the public to access documents.

Depending on the level of community response and level of interest, DTSC may hold a community meeting to discuss the components of the RAP, the Site's history, and proposed remedial work. The meeting may also provide the opportunity for the public to submit comments regarding the RAP. DTSC will work with the community to develop a meeting format that suits the community's needs.

REMEDIAL ACTION PLAN
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

1.0 REMEDIAL ACTION PLAN

AMEC Geomatrix, Inc. (AMEC), has prepared this Remedial Action Plan (RAP) on behalf of Pechiney Cast Plate, Inc. (Pechiney) for the former Pechiney facility (Vernon Facility or Site) located at 3200 Fruitland Avenue in Vernon, California (Figure 1).

A Feasibility Study (FS) (AMEC, 2011a) has been prepared on behalf of Pechiney, to evaluate potential remedial technologies and provide recommendations for the proposed, preferred remedy for impacted soil and soil vapor within the vadose zone, and impacted concrete at the Site. The FS was submitted to the Department of Toxic Substances Control (DTSC). The FS was completed using the Code of Federal Regulations (CFR), Title 40, Section 300, also known as the National Contingency Plan (NCP), and appropriate guidance documents developed by the United States Environmental Protection Agency (U.S. EPA), including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Remedial Investigation/Feasibility Study guidance (U.S. EPA, 1988).

This RAP was prepared in accordance with DTSC guidance and policy for RAP development (DTSC policy #EO-95-007-PP), and pursuant to California Health and Safety Code Section 25356.1. This RAP provides the details and procedures for remediating polychlorinated biphenyl (PCB)-impacted concrete during demolition of below-grade features, and remediating impacted soil and soil vapor during and following below-grade demolition. On July 6, 2010, DTSC issued an Imminent and Substantial Endangerment Determination and Consent Order (Order) (DTSC, 2010) for the Site. DTSC has the final approval authority for the implementation of this site-wide RAP. However, pursuant to CFR, Title 40, Subchapter R, Toxic Substances Control Act (TSCA), Part 761 (40 CFR 761), the U.S. EPA has approval authority for risk-based remediation of PCB releases and disposal of PCB remediation waste (soil and concrete). Pechiney will implement the RAP pursuant to the Order, and subject to DTSC's approval of the RAP and U.S. EPA approval of the PCB risk-based application referred to as the Polychlorinated Biphenyls Notification Plan (PCBNP) (AMEC, 2009) for the Site. On July 2, 2010, U.S. EPA issued a conditional approval letter regarding the PCBNP, which outlined requirements for additional PCB sampling and submission of additional information. In the conditional approval letter, U.S. EPA also deferred the approval of the PCB remediation goals until the additional PCB sampling results and information was submitted to

U.S. EPA for review, which was submitted to U.S. EPA on December 29, 2010. U.S. EPA's conditional approval of the PCB remediation goals was obtained on July 1, 2011.

1.1 INTRODUCTION

The Site is comprised of approximately 26.9 acres (including Assessor Parcel Numbers 6301-008-010, -011, -012, -013, which was divided into Parcels 6, 7, and 8) and was formerly occupied by approximately 600,000 square feet of building area. The Site was used to manufacture high-precision cast aluminum plates. As part of the demolition work completed in November 2006, the above-ground features, including the former manufacturing facilities, were demolished; leaving the concrete floor slabs in place, and the debris was transported off site for disposal or recycling.

Remediation of remaining impacted concrete and soil will be conducted in conjunction with demolition of remaining surface slabs and below-grade features. This work will include removal of man-made structures, building slabs, pavements, footings, foundations, pits, and sumps located within the footprint of the former buildings as described in the Below Grade Demolition Plan (Geomatrix Consultants Inc. [Geomatrix], 2006a) previously approved by the City of Vernon.

1.2 REPORT STRUCTURE

This RAP includes the following information (listed by relevant section).

- Section 1.0 provides an introduction to the RAP and defines the report structure.
- Section 2.0 provides Site background information.
- Section 3.0 summarizes the results of the remedial investigation.
- Section 4.0 describes the removal actions completed to date.
- Section 5.0 presents a summary of Site risks.
- Section 6.0 provides a summary evaluation of the remedial alternatives considered in the FS.
- Section 7.0 discusses implementation of the preferred remedial alternative, and provides additional details related to soil management of any new, undiscovered releases that might be encountered during below-grade demolition or RAP implementation.
- Section 8.0 discusses the public participation and community involvement process.
- Section 9.0 provides report references.

2.0 SITE BACKGROUND

Aluminum Company of America's (Alcoa's) manufacturing operations reportedly began at the Site in approximately 1937 and included production of high-precision cast aluminum plates. As part of their manufacturing operations, Alcoa (original Site owner) used fuels and Stoddard solvent, both of which were stored in underground storage tanks (USTs). Alcoa used Stoddard solvent during the aluminum manufacturing process. Alcoa also operated processes that required lubricating and hydraulic oils and generated hazardous waste that was stored at various locations throughout the Site. The historical site layout is shown on Figure 2.

Previous investigations were conducted at the Site for soil, groundwater, soil vapor, and building materials. During these investigations, soil impacted with petroleum hydrocarbons (including Stoddard solvent), metals, PCBs, and volatile organic compounds (VOCs) were identified. The presence of chlorinated VOCs also was identified in groundwater at a depth of approximately 150 feet below ground surface (bgs) within the southwestern portion of Parcel 7, west of Building 112A and within the northern portion of the Buildings 106/108 on Parcel 8.

In approximately 1997, Alcoa sold the eastern half of its facility, which subsequently was razed, subdivided, and redeveloped for industrial and commercial uses. Prior to 1999, Alcoa investigated subsurface conditions and conducted limited remediation in both the eastern and western portions of its facility as part of its efforts to close its City of Vernon Health and Environmental Control) (H&EC) hazardous materials permit. These activities are described in Section 3. In December 1998, Alcoa sold the western portion of the facility (3200 Fruitland Avenue) to Century Aluminum Company. In 1999, Pechiney purchased the Site, and subsequently closed the Vernon facility in January 2006.

This preferred remedial alternative discussed in this RAP addresses principal risk threats posed by chemicals of concern (COCs) present at the Site. These principal risks include PCB-impacted concrete, surface and shallow COC-impacted soil (at depths less than or equal to 15 feet), deep Stoddard solvent-impacted soil (at depths greater than 15 feet), and deep VOC-impacted soil at the Site. RAP implementation will reduce the potential for risks to human health due to exposure to shallow soil containing COCs, and remediation of deeper COC-impacted soil that may potentially affect groundwater quality.

The RAP also covers the materials management practices that will be implemented during below-grade demolition, and excavation and removal of non-COC-impacted concrete and soil at the Site.

3.0 SUMMARY OF REMEDIAL INVESTIGATIONS

Previous remedial investigations performed by prior Site owners and Pechiney are summarized below.

3.1 ALCOA'S PREVIOUS INVESTIGATIONS

Previous investigations were conducted by consultants to Alcoa and were related to closure of Alcoa's facilities and operations on and east of the Site (including Alcoa's efforts to seek closure of its City of Vernon H&EC hazardous materials permit). A summary of previous Alcoa investigations is presented in the Phase I Environmental Site Assessment (ESA) (Geomatrix, 2005a) and the FS (AMEC, 2011a). These previous investigations included the collection and analysis of soil, groundwater, soil vapor, and building materials samples, and were conducted under the oversight of the City of Vernon H&EC. During these investigations, soil impacted with petroleum hydrocarbons (including Stoddard solvent), metals, PCBs, and VOCs were identified. The presence of chlorinated VOCs (trichloroethene [TCE], 1,2-dichloroethane [1,2-DCA], and chloroform) also was identified in groundwater at a depth of approximately 150 feet bgs within the southwestern portion of Parcel 7, west of Building 112A.

Nine groundwater wells were constructed at the Site between 1990 and 1991 by Alcoa under the oversight of the City of Vernon H&EC. All but three of the monitoring wells (AOW-6, AOW-8, and AOW 9) were destroyed by Alcoa under the oversight of the City of Vernon H&EC. The three remaining groundwater monitoring wells are located near former Building 112A in the southern portion of Parcel 7. Groundwater quality data collected from monitoring wells sampled and analyzed between 1990 and 1997 indicated the presence of TCE, 1,2-DCA, and chloroform in groundwater (upper portion of the Exposition aquifer) beneath the southwest portion of the Site with historical concentrations of 160 micrograms per liter (µg/L), 370 µg/L, and 105 µg/L, respectively, of TCE, 1,2-DCA and chloroform (Enviro-Wise, 1998). The highest concentrations of these VOCs were detected in groundwater in the vicinity of the former Stoddard solvent USTs located outside of Building 112A in Parcel 7.

Previous evaluations conducted by Alcoa suggested the source of VOCs in groundwater in the southwest portion of Parcel 7 was from an upgradient, off-site source. At the time, the City of Vernon H&EC concurred with this evaluation, but because the closure of the groundwater wells required the California Regional Water Quality Control Board, Los Angeles Region (RWQCB) concurrence and approval, Alcoa submitted its recommendations for Site closure to the RWQCB on February 18, 1999 (Alcoa, 1999). Because groundwater at these wells was impacted with chlorinated VOCs and because the wells were located in an area associated with the former Stoddard solvent USTs, the RWQCB required that Alcoa perform additional analysis of groundwater for methyl tertiary-butyl ether and fuel oxygenates (RWQCB, 2002). Alcoa conducted additional monitoring of the remaining three groundwater wells in 2005 and

2006 and submitted the monitoring data to the RWQCB. Based on the monitoring results, the concentrations of chlorinated VOCs decreased relative to the concentrations reported earlier (1990-1997). The compounds TCE, 1,2 DCA, and chloroform were detected at concentrations up to 28 µg/L, 6.1 µg/L, and 8.6 µg/L, respectively, during the most recent sampling event conducted in 2006 (URS Corporation, 2006). These compounds were not detected in groundwater samples collected from well AOW-6.

In a March 28, 2008 letter, the RWQCB directed Alcoa to 1) provide a work plan to characterize residual soil contamination in the former Stoddard solvent UST area and submit a site-specific health and safety plan by April 25, 2008; 2) sample the groundwater wells in the former UST area (AOW-7, AOW-8 and AOW-9) or install and sample replacement groundwater wells if AOW-7, AOW-8 and AOW-9 cannot be used or located; 3) submit additional historical reports and data related to the Stoddard solvent releases; 4) analyze soil and groundwater for a specific suite of petroleum hydrocarbon compounds and VOCs; 5) log and sample soil at 5-foot intervals, at lithologic changes, or observed impacted soil; and 6) initiate electronic submittals through the State database (RWQCB, 2008a).

On December 18, 2008, the RWQCB (2008b) determined that the impacts associated with chlorinated solvents in soil and groundwater at the Site, including the area of the former Stoddard solvent USTs, should be addressed under the jurisdiction of the DTSC. On January 16, 2009, the RWQCB confirmed completion of Alcoa's site investigation and corrective actions to address soil impacts related to eight former USTs containing gasoline, diesel/No. 2 fuel oil, and waste oil. The RWQCB specially excluded "subsequent investigations and/or remediation of the residual contamination associated with chlorinated solvents in soil and groundwater for the entire site, including the area [formerly] containing four Stoddard solvent USTs." In addition, RWQCB closure documentation specifically excluded the closure of the four Stoddard solvent USTs (referred to as USTs T-9 through T-12). The RWQCB deferred these remaining issues to the DTSC's oversight. Although the Stoddard solvent impacts remain the responsibility of Alcoa, as directed by September 2, 1999 and July 18, 2006 letters from the City of Vernon H&EC, and a January 16, 2009, letter from the RWQCB, Alcoa has not taken responsibility for these impacts. Pursuant to the DTSC Order and the above actions, the Stoddard solvent-impacts and associated residual petroleum hydrocarbon-impacts have been included in this RAP.

3.2 GEOMATRIX INVESTIGATIONS

In June 2005, Geomatrix conducted a Phase I ESA (Geomatrix, 2005a) at the Vernon Facility to identify Recognized Environmental Conditions (RECs) as defined by ASTM International, Inc. E1527-00 for Phase I ESAs. In addition to identifying RECs, Geomatrix identified historical RECs and the potential of other environmental conditions (OECs) at the Site. The

Phase I ESA report was submitted to the City of Vernon on September 1, 2005, and the City of Vernon H&EC concurred with the findings in their letter dated September 26, 2005. The findings of the Phase I ESA indicated the need for additional subsurface investigation work at the Site. Geomatrix submitted a Phase II ESA work plan (Geomatrix, 2005b) to the City of Vernon H&EC on September 2, 2005, and the work plan was approved by the City of Vernon H&EC on September 26, 2005 (City of Vernon, 2005). A summary of the Geomatrix investigations is described in the following subsections.

3.2.1 Phase II Investigation

Based on the findings of the previous investigations and the manufacturing operations in each building and/or area, these chemicals of potential concern (COPCs) were identified:

- total petroleum hydrocarbons (TPH), including Stoddard solvent compounds;
- PCBs (as total Aroclors);
- VOCs;
- metals, including hexavalent chromium [Cr (VI)]; and
- semi-volatile organic compounds (SVOCs).

Based on Alcoa's historical groundwater monitoring results, TCE; 1,2-DCA; and chloroform were identified as groundwater COPCs at the Site.

A Phase II investigation was conducted as the initial remedial investigation at the Site between November and December 2005. The investigation was conducted to evaluate whether the RECs or OECs identified in the Phase I ESA had resulted in releases to the subsurface soil and/or groundwater at the Site. The initial remedial investigation included the collection and analysis of concrete, soil vapor, and soil samples for a number of constituents. The findings of the investigation were submitted to the City of Vernon H&EC in a report dated March 9, 2006 (Geomatrix, 2006b).

Soil and soil vapor data collected during the Phase II investigation were evaluated using a stepped screening process to evaluate the potential for groundwater impacts and the potential for risks to human health due to exposure to shallow soil containing COPCs. The initial step of the screening process was used to evaluate potential VOC impacts and the need to collect additional soil samples. Based on the soil vapor results obtained in Building 106, the collection and analysis of additional soil samples were required to further assess potential VOC impacts.

The second step of the screening evaluation included a comparison of the Phase II soil sample results to the following prescriptive regulatory screening levels.

- Los Angeles RWQCB Interim Site Assessment and Cleanup Guidebook (May 1996, and updated March 2004) groundwater protection screening levels for carbon range-specific petroleum hydrocarbons and aromatic hydrocarbons (benzene, toluene, ethylbenzene, and total xylenes [BTEX] compounds) in soil. The selected screening levels were obtained from Table 4-1 of the above-referenced RWQCB guidance assuming a sand lithology and a depth to groundwater of 150 feet.

- U.S. EPA Region IX Preliminary Remediation Goals (PRGs) for industrial sites and concentrations for VOCs, SVOCs, PCBs, and metals in soil (U.S. EPA, 2004).

- U.S. EPA Region IX soil screening levels (SSLs) for the protection of groundwater using a default dilution attenuation factor of 20 (DAF20) for VOCs, SVOCs, and metals, where available (U.S. EPA, 2004).

- California Background Concentrations of Trace and Major Elements in California Soil (Bradford, et al., 1996).

- California Code of Regulations, Title 22, Total Threshold Limit Concentration and Soluble Threshold Limit Concentration for metals and PCBs in building materials (waste characterization).

Based on the data collected during the Phase II investigation and the above screening evaluation process, certain areas at the Site were identified as impacted by one or more COPCs at concentrations greater than the screening criteria. Although the screening criteria are not intended to be remediation goals, they were used to evaluate the potential need for further action (such as additional investigation, analysis, or potential remediation). Remediation goals may differ from screening levels based on site-specific considerations (e.g., redevelopment, future land use, potential exposure pathways, etc.), regulatory requirements, evaluation of risk, or other relevant factors as set forth in NCP 40 CFR 300.

The following areas of the Site had COPCs that exceeded one or more of the screening criteria (the boring locations discussed below are shown on Figure 3). For each of these areas, the results of the Phase II investigation indicated that additional investigation was required and the City H&EC approved these subsequent investigatory actions on March 20, 2006.

- Building 104 – PCBs were detected in the concrete slab and soil to a depth of 3 feet bgs adjacent to the location of a saw (borings 41, 73, and 74). Additional soil borings were required in the vicinity of the saw to assess the source and extent of PCBs detected in concrete and the underlying soil.

- Building 104 – PCBs were detected in soil to a depth of approximately 71.5 feet bgs in the vicinity of a vertical pit and a former vertical pit (boring 40). Additional soil borings were required near both vertical pits to assess the source and extent of PCBs detected in soil.

- Buildings 106 and 108 – TCE was detected in soil beneath the northern portion of the buildings to a depth of approximately 48 feet bgs (boring 14), and TCE was detected in soil vapor. Additional investigation of the lateral extent of TCE in soil and its potential impacts to groundwater was required in this area.

- Building 112 (former etch station) and near storm water outfall #6 – one or more metals were detected in soil to a depth of 6 feet bgs (boring 113). Additional investigation of the lateral extent of metals in shallow soil was required in these areas.

- Former Substation #8 – PCBs were detected in the soil and gravel drainage area of the former substation to a depth of 2.2 feet bgs (boring 39), but PCBs were not detected in the soil boring adjacent to the drainage area. Additional investigation of the depth of the soil and gravel drainage area and the concentrations of PCBs in these materials was required.

Although concentrations of COPCs in other areas of the Site did not exceed screening criteria, additional remedial investigations were required by the City of Vernon H&EC at three locations to obtain a better understanding of the source of the deeper soil impacts and to confirm that soil concentrations were not increasing with depth. These three locations are listed below.

- Building 106 – Stoddard solvent-range petroleum hydrocarbons were detected in one soil sample at a depth of approximately 46.5 feet bgs (boring 13). Because these hydrocarbon compounds were not detected in shallow soil at this boring or in soil vapor in the vicinity of the boring, further investigation of the source of these compounds at 46.5 feet bgs in soil was required.

- Building 112 – TPH concentrations in soil increased with depth at a boring drilled to a depth of 9.6 feet adjacent to a former sump (boring 30). Although the hydrocarbon concentrations were below the screening levels, their vertical extent in soil adjacent to the sump had not been characterized and required further evaluation.

- Cooling Tower area – Cr (VI) and PCBs (Aroclor-1248) were detected in one soil sample from boring 46 at a depth of 21.1 feet bgs (the bottom of the boring). PCBs and Cr (VI) were not detected in shallow soil samples collected from boring 46, and therefore, further investigation of the source of PCBs and Cr (VI) detected at 21.1 feet bgs in soil was required.

3.2.2 Supplemental Phase II Investigations

The Phase II remedial investigation results indicated a need to 1) assess the extent of impacted soil exceeding the screening criteria, 2) assess potential impacts to groundwater, and 3) further understand the subsurface conditions at the Site for each of the areas identified in Section 3.2.1. Therefore, a Supplemental Phase II investigation was required in specific areas of the Site to further characterize the extent of impacted soil and/or existing subsurface conditions for the reasons described above in Section 3.2.1. On March 9, 2006, Geomatrix submitted a proposed plan to the City of Vernon H&EC to further characterize the extent and potential significance of COPCs exceeding screening criteria in soil at the Site and the potential impacts to groundwater related to TCE detections in soil and soil vapor in Buildings 106 and 108. On March 20, 2006, the City of Vernon H&EC approved the Supplemental Phase II investigation plan, and the investigation was conducted between March 28, 2006, and April 24, 2006.

Based on the findings of the initial Supplemental Phase II investigation, a follow-up investigation was required to further characterize the extent of VOCs detected in soil, soil vapor, and groundwater in the north portion of the Site. In a letter to the City of Vernon H&EC dated May 9, 2006, Geomatrix identified additional sampling points in Buildings 106, 108, and 112. Under approval and direction from the City of Vernon H&EC, the additional investigation work began on May 11, 2006, and was completed on May 24, 2006. The findings of the Supplemental Phase II investigation were submitted to the City of Vernon H&EC in a report dated December 19, 2006 (Geomatrix, 2006c).

Soil data collected during the Supplemental Phase II investigation were evaluated using the stepped screening process discussed in Section 3.2.1, and sample locations where COPCs were detected above the screening levels are described in Section 3.5.

3.2.3 Geomatrix Concrete Characterization for PCBs as Aroclors

In addition to the concrete testing conducted during the Phase II investigation, coring and testing of the concrete slabs and concrete transformer pads were performed during and after above-grade demolition work to further characterize PCB-impacted concrete. PCBs were detected in concrete samples at "total Aroclor" concentrations (the sum of detected Aroclor-1016, -1221, -1232, -1242, -1248, -1254, and -1260) greater than 1 mg/kg in portions of Buildings 104, 106, 108, 110, 112, and 112A. A summary of PCBs as total Aroclor concentrations for the concrete samples is depicted on Figure 4. The results for all tested Aroclors (Aroclor-1016, -1221, -1232, -1242, -1248, -1254, and -1260) are provided in Appendix A of the FS (AMEC, 2011a).

3.3 AMEC Supplemental Soil Vapor Testing

As a continuation of the remedial investigation work at the Site, Pechiney was directed by DTSC to conduct an off-site soil vapor survey at the intersection of Fruitland and Boyle Avenues near the northwest corner of the Site in July of 2009. DTSC required the work to assess the off-site extent of VOC concentrations in shallow soil vapor in the vicinity of former Building 106. In addition, and in order to meet DTSC's requirements for evaluating human health risk related to vapor intrusion, a shallow soil vapor survey was conducted within the footprint of Building 112A and to the west of the building in the vicinity of the former Stoddard solvent UST area. This work was required due to the lack of soil vapor data. The soil vapor survey was conducted to complete the human health risk assessment (HHRA) for potential indoor air exposure to Stoddard solvent and associated compounds. The findings of this work are provided in the FS and tabulated analytical results are included in Appendix A of the FS (AMEC, 2011a). The results of the testing are discussed in Section 3.5.

3.4 AMEC Supplemental Soil and Concrete Characterization

In July 2009, AMEC submitted the PCBNP (AMEC, 2009) to U.S. EPA for approval of a risk-based application for on-site remediation of PCB releases and disposal of PCB remediation waste (soil and concrete). The PCBNP was prepared in compliance with 40 CFR 761 (Subchapter R, TSCA), including applicable amendments (June 29, 1998, 40 CFR Parts 750 and 761, Disposal of Polychlorinated Biphenyls, Final Rule). Following U.S. EPA's review of the risk-based application, U.S. EPA required additional testing, which included the following:

- collection and analysis of additional concrete cores for PCBs as Aroclors from 50 randomly selected concrete slab areas;
- collection and analysis of soil directly beneath PCB-impacted concrete slabs (referred to as sub-slab soil samples), where the total Aroclor concentration of the concrete slab exceeded the then proposed remediation goal of 5.3 mg/kg for concrete; and
- collection and analysis of additional soil and concrete for PCBs and dioxin-like PCB congeners to support the HHRA and proposed risk-based remediation goals for PCBs.

Specific protocols and sampling requirements were outlined in a draft Concrete and Soil Sampling and Analysis Plan (SAP) (AMEC, 2010a), which was submitted to U.S. EPA pursuant to its conditional approval of the PCBNP (U.S. EPA, 2010). The SAP was approved with modifications by U.S. EPA on August 30, 2010. The sampling covered under the SAP was conducted between September 9, 2010, and October 18, 2010, with final laboratory analytical data received on November 8, 2010. The results of the additional PCB (tested Aroclors and sum of detected Aroclors) concrete and soil sampling are provided in Appendix A of the FS (AMEC, 2011a); a summary of total Aroclor concentrations for the 2010 concrete samples are shown on Figure 4..

3.5 Areas of Impact

Although the screening criteria described in Section 3.2.1 are not intended to be remediation goals, one or more COPCs were detected in soil and/or concrete at concentrations above these screening criteria during the Phase II and Supplemental Phase II investigations conducted by Geomatrix and AMEC. The areas identified as impacted by one or more COPCs with concentrations exceeding these initial screening criteria are described below.

With the exception of storm water outfalls #6 and #7 and former hot well area, these areas were not previously identified as being impacted by VOCs or PCBs.

- Northern Portion of Buildings 106, 108, and 112 – TCE was detected in soil vapor, soil, and groundwater in the northwestern portion of the Site. Data collected to date indicate the likely presence of a source of VOCs in soil and groundwater in the northwest corner of Building 106. TCE and tetrachloroethene (PCE) concentrations detected in soil exceed the U.S. EPA Region IX SSL for the protection of groundwater (using a DAF20) in this area. TCE was detected in groundwater samples collected from a depth of approximately 150 feet bgs at concentrations ranging from 72 to 420 μg/L. In addition, PCBs were detected in the concrete slab in portions of these buildings, and PCBs were detected in sub-slab soil samples at three discrete locations between Building 106 and 108 (sample locations 191, 193 and 195).

- Off site Northwest of Building 106 - the investigation of off-site soil vapor concentrations to the northwest of Building 106, at the intersection of Fruitland and Boyle Avenues, identified TCE and PCE in shallow soil vapor samples at depths of 5 and 15 feet (sample locations 161 through 164). At these off-site locations, TCE soil vapor concentrations decreased to the north and west of the Site, while the PCE soil vapor concentrations increased. For comparison, the molar ratios of PCE to TCE (0.10 and 0.42) were an order of magnitude higher at three of the off-site soil vapor sample locations. The molar ratios calculated for the on-site samples from the suspected source area ranged between 0.01 and 0.087. The observed higher PCE concentrations and PCE to TCE molar ratios suggest the probability of an off-site source of PCE in the vicinity of the off-site sample locations (162, 163, and 164).

- Southern Portion of Building 106 – aromatic VOCs, primarily benzene, were detected in soil and groundwater in the southern portion of the building at borings 125 and 135. Benzene was detected in groundwater samples at concentrations ranging from 2.8 to 3.3 μg/L. PCBs also were detected in the concrete slab at the southwest corner of this building, at isolated locations within the sub-slab soil (sample locations S-1 and 39) underlying the concrete slabs, and at near former Substation 8 (sample location S-1).

- Storm Water Outfall #7 – PCBs were detected in soil at a depth of 5.7 feet bgs at boring 182.

- Existing and Former Vertical Pits in Building 104 – PCBs were detected in soil to a depth of 31 feet bgs at boring 98 and at depths between 10 and 71.5 feet bgs at borings 40, 94, 95, and 189.

- Northwestern Portion of Building 104 – PCBs were detected in the concrete slab at the northwest corner of the building. PCBs were not detected in soil samples from borings 115, 116, 117, 118, and 119 located in this area of the building or from the sub-slab soil sample locations 215 through 225.

- Saw Area in Building 104 – PCBs were detected in soil to a depth of 3 feet bgs at borings 41, 73, and 100 and from the sub-slab soil sample locations 228 through 233 and 236. PCBs also were detected in the overlying concrete slabs near these boring and sample locations and surrounding the location of the saw.
- Former Hot Well area – PCBs were detected in soil at a depth of 2.7 feet bgs at boring 175.
- Building 112A and West of Building 112A – Stoddard solvent and associated VOC compounds (naphthalene, trimethylbenzenes, and xylenes) were detected in soil vapor at depths of 5 and 15 feet bgs.
- Former Scalper/Planar Area – PCBs were detected in soil at a depth of 0.8 feet bgs at boring 183.
- Near Storm Water Outfall #6 – copper and lead were detected at a depth of 6.2 feet bgs at former boring 47, and arsenic was detected at a depth of 6.0 feet bgs at boring 113. PCBs also were detected in soil at a depth of 4.5 feet bgs at boring 176.

In order to further evaluate these areas of impacted soil vapor, soil or concrete, the Phase II data, the Supplemental Phase II investigation data, and all other COPCs detected in soil and soil vapor at the Site were evaluated for potential human health risks using a screening-level HHRA pursuant to NCP 40 CFR 300.430(d)(1) and DTSC guidance documents. The screening-level HHRA and the potential impacts of these COPCs to groundwater are presented and evaluated in the FS (AMEC, 2011a). A summary of the screening-level HHRA is presented in Section 5.0.

4.0 REMOVAL ACTIONS COMPLETED TO DATE

This section summarizes removal actions and follow-up, additional investigations performed by Alcoa, along with facility building demolition actions performed by Pechiney.

4.1 ALCOA'S PREVIOUS REMEDIAL ACTIVITIES

Consultants to Alcoa have previously conducted remediation activities in specific areas of the Site under the direction of the City of Vernon H&EC. These remediation activities are briefly described below.

- July to October 1992 – excavation of diesel fuel-impacted soil in conjunction with removal of three 10,000-gallon diesel USTs and a pump vault located south of electrical substation #2. The excavations were backfilled with engineered fill, compacted, and capped with concrete (OHM Remediation Services Corporation, 1992).

- January 1995 – removal of four 10,000-gallon Stoddard solvent USTs located west of Building 112A. The maximum excavation depth was 18 feet bgs. The area was backfilled with Stoddard solvent-impacted soil from 3 to 18 feet bgs. At that time, the City of Vernon H&EC "agreed that Alcoa could place the contaminated soil back into the excavation, provided that Alcoa would remediate the Site within a reasonable time frame" (CCG Group, Inc., 1995). A 6-mil plastic liner was placed over the Stoddard solvent-impacted soil, and clean soil was backfilled over the liner from 3 feet bgs to grade. The area was then capped with concrete.

  Following the removal of the Stoddard solvent USTs and delivery system in January 1995, Alcoa conducted a soil investigation to evaluate the extent of the Stoddard solvent impacts (Morrison Knudsen Corporation, 1995). A number of investigations were performed by Alcoa between 1995 and 2005 (Environmental Protection and Compliance, 2006), and these investigations are described below. .

  - September through October, 1995 – Alcoa conducted an initial soil investigation to evaluate the extent of Stoddard solvent-related soil impacts beneath Building 112A and west of the building near the former Stoddard solvent USTs (Morrison Knudsen Corporation, 1995). The areas investigated included the former tube mill and roll stretcher machine area (Area "A" borings), the former tube mill Stoddard solvent dip tanks and vault (Area "B" borings), the scalper planar machine and Stoddard feed line area (Area "C" borings), and the Stoddard solvent still house and UST area (Area "D" borings). Soil borings were advanced to depths between 45 to 67.5 feet bgs and cone penetration test/rapid optical screening test (CPT/ROST) borings were advanced to depths between 34 and 80.7 feet bgs. Petroleum hydrocarbon analyses included quantification of total volatile petroleum hydrocarbons (TVPH; carbon-chain range of c6 – c10) and total extractable petroleum hydrocarbons (TEPH; carbon chain range of c10 – c28). The soil TVPH concentrations ranged between 1.1 milligram per kilogram (mg/kg) to 76,000 mg/kg and TEPH concentrations ranged between 5.4 mg/kg to 53,000 mg/kg. The highest concentrations of these compounds were detected in Area B at depths between 46.5 and 50 feet bgs. Several soil samples also were tested for BTEX compounds, and these compounds were detected in soil. Based on AMEC's review of the soil sample analytical results and qualitative petroleum hydrocarbon measurements obtained by CPT/ROST methods, the extent of these soil-impacts was assessed with the exception of two areas. The vertical extent of petroleum hydrocarbon-impacted soil was not completely assessed in Areas B and D. The approximate lateral extent of the Stoddard solvent-related soil impacts are shown on Figure 3 and the historical analytical soil results are included in Appendix A of the FS (AMEC, 2011a).

  - August to November 1995 – Alcoa completed laboratory bench-scale treatability testing on Stoddard solvent-impacted soils obtained from the subsurface in the vicinity of former solvent handling and storage areas within Building 112A. The testing was conducted to determine the applicability of in situ bioremediation of vadose zone soils. The treatability testing included the use of bioslurry reactor vessels and soil column reactors (Alcoa Technical Center, 1996a).

- Analytical testing indicated that appropriate environmental conditions (including pH, naturally occurring nutrients, indigenous microbial populations, and soil moisture) existed to depths of 45 feet bgs that would be supportive of in situ biodegradation of Stoddard solvent-impacted soil. The primary findings associated with the bioslurry reactor testing indicated that under optimal test conditions, 50 percent of the hydrocarbons were degraded within four weeks under aerobic conditions within the reactor, and that less than 5 percent of the hydrocarbons were lost due to volatilization. The primary findings from column reactor studies further supported that Stoddard solvent-impacted soils were amenable to biodegradation as hydrocarbon concentrations were reduced by 93 to 95 percent using a combination of biodegradation (80 percent) and volatilization (13 to 14 percent). Furthermore, significantly high levels of heterotrophic bacteria (10^8 to 10^9 colony forming units per gram of soil dry weight [cfu/gm-dw soil] and hydrocarbon degraders (10^5 to 10^6 cfu/gm-dw soil) were found to be present within the soil (Alcoa Technical Center, 1996a). The results indicated that the addition of moisture and nutrients did not significantly alter degradation rates of the hydrocarbons.

- In 1995, on behalf of Alcoa, Morrison Knudson Corporation and Groundwater Technology performed field trial tests to evaluate the applicability of soil vapor extraction (SVE) and bioventing technologies as remedial alternatives to mitigate the Stoddard solvent-impacted soils at the Site. Test procedures consisted of both vapor extraction and air injection with monitoring for oxygen, carbon dioxide, and soil gas. The report concluded that both technologies were viable and could be implemented if desired to remediate the Stoddard solvent-impacted soils (Alcoa Technical Center, 1996a).

- In 1996, Alcoa generated additional field respirometry testing data suggesting that naturally-occurring aerobic and anaerobic intrinsic bioremediation was on-going at the Site. The data indicated that natural aerobic degradation was occurring due to available molecular oxygen at rates of 200 to 400 mg/kg per year (mg/kg/year). The data also indicated that much slower degradation rates of 7 mg/kg/year were occurring through anaerobic biodegradation. The report indicated that Alcoa proposed intrinsic bioremediation (also referred to as monitored natural attenuation) as the passive full-scale remediation approach for Stoddard solvent-impacted soils (Alcoa Technical Center, 1996b).

- September and October 2005 - Alcoa conducted additional soil testing in 2005 to monitor the progress of the natural degradation of Stoddard solvent-related soil impacts in soil boring areas A, B, C and D (Environmental Protection and Compliance, 2006). AMEC compared the soil data collected in 2005 by Environmental Protection and Compliance to the soil data collected in 1995 by Morrison Knudsen Corporation to evaluate petroleum hydrocarbon concentration changes over time. The findings of this comparison are summarized below.

Area	Findings
A	• TVPH and TEPH concentrations decreased over time. • Remaining TVPH and TEPH maximum concentrations reported in 2005 were at 6080 mg/kg and 6200 mg/kg, respectively.

Area	Findings
	• Concentrations greater than 1000 mg/kg remain at depths of 30 and 40 feet. • Vertical extent of soil impacts was assessed to 60 feet.
B	• TVPH and TEPH concentrations increased over time at several depth intervals. • Remaining TVPH and TEPH maximum concentrations reported in 2005 were at 41,600 mg/kg and 60,600 mg/kg, respectively (at a depth of 45 feet in boring B-1). • Concentrations greater than 10,000 mg/kg remain at depths of 45 and 50 feet. • Vertical extent was not assessed; TPH-impacted soil was detected to a depth of 50 feet.
C	• TVPH and TEPH concentrations decreased over time. • Remaining TVPH and TEPH maximum concentrations reported in 2005 were at 2220 mg/kg and 2500 mg/kg, respectively. • TVPH concentrations greater than 1000 mg/kg remain at a depth of 15 feet and TEPH concentrations greater than 1000 mg/kg remain at depth of 45 feet. • Vertical extent of soil impacts was assessed to 65 feet.
D	• TVPH and TEPH concentrations increased over time at several depth intervals. • Remaining TVPH and TEPH maximum concentrations reported in 2005 were at 6020 mg/kg and 10,800 mg/kg (at 45 feet at boring D-2). • TVPH and TEPH concentrations greater than 1000 mg/kg remain at depths of 15, 43, and 44.5 feet and TEPH concentrations greater than 10,000 mg/kg remain at a depth of 45 feet. • Vertical extent was not assessed; TPH-impacted soil was detected to a depth of 45 feet.

  - Based on the soil investigations and treatability testing described in a report prepared by Environmental Protection and Compliance in 2006, Alcoa recommended to the City of Vernon H&EC that long-term natural attenuation of the Stoddard solvent-impacted soils beneath Building 112A be allowed to continue as a passive remedy (Alcoa Technical Center, 1996c). The City of Vernon H&EC replied that the remaining Stoddard solvent contamination still exceeded cleanup standards and required Alcoa to submit a plan by August 31, 2006 for active remediation of this area (City of Vernon, 2006). Alcoa has not submitted its active remediation plan and has not performed any additional monitoring or active remediation work in this area. Alcoa's refusal to submit an active remediation plan is documented in an August 30, 2006 letter that Alcoa submitted to the City of Vernon H&EC (Alcoa, 2006).

- April 1998 – excavation of TPH-impacted soil in conjunction with removal of the Stoddard solvent Tube Mill dip tank located in Building 112A. The maximum excavation depth was 15 feet bgs. The area was backfilled with pea gravel and capped with concrete (A.J. Ursic, Jr., 1999a).

- June 1998 – excavation of TPH-impacted soil in conjunction with the removal of a sump from the 3-inch tube reducer foundation located in Building 112A. The maximum excavation depth was 5 feet bgs. The area was backfilled with native soil and capped with concrete (A.J. Ursic Jr., 1999a).

- October 1998 – excavation of refractory and asbestos-containing materials found in soil in conjunction with the construction of a sanitary pipeline located east of Building 112A. The maximum excavation depth was 4 feet bgs. The area was backfilled with road base and capped with asphalt (A.J. Ursic Jr., 1999a).

- December 1998 – excavation of PCB- and TPH-impacted soil in conjunction with the removal of an inert waste disposal pit located west of Building 112A and south of the cooling tower. The maximum excavation depth was 45 feet bgs. Soil removal was terminated due to the proximity of the railroad tracks along the south and west sides of the excavation. The area was backfilled with soil and road base and capped with concrete (A.J. Ursic Jr., 1999a).

- January 1999 – excavation of PCB-impacted soil near storm water outfall #7 located west of Building 104. The maximum excavation depth was 6 feet bgs. The area excavated was limited by the presence of the adjacent sidewalk, building structures, and railroad tracks. The area was backfilled and capped with road base (A.J. Ursic Jr., 1999b).

- April 1999 – excavation of PCB-impacted soil at the discharge point of storm water outfall #6 located southwest of the cooling tower. The maximum excavation depth was 2 feet bgs. The area was backfilled and capped with road base (A.J. Ursic Jr., 1999a).

- April 1999 – excavation of PCB-impacted soil adjacent to the hot well along the north side of the cooling tower. The maximum excavation depth was 3 feet bgs. The area was backfilled and capped with road base (A.J. Ursic Jr., 1999a).

- May 1999 – excavation of PCB-impacted soil in conjunction with removal of a former condenser pad located outside the northwest corner of Building 106. The maximum excavation depth was 2 feet bgs. The area was backfilled with native soil and capped with concrete (A.J. Ursic Jr., 1999b).

- May 1999 – excavation of lead-impacted soil from a former ceramic disposal pit located beneath Building 135 on Parcel 6. The maximum excavation depth was 2 feet bgs. The area was backfilled with native soil and capped with asphalt (A.J. Ursic Jr., 1999c).

- June 1999 – excavation of PCB-impacted soil in conjunction with the removal of a French drain in Press Pit #2 located in Building 106. The maximum excavation depth was 7 feet bgs. The area was backfilled and capped with concrete (A.J. Ursic Jr., 1999b).

The areas where previous remediation activities occurred as described above, including approximate horizontal limits of the excavation, excavation depth, and concentrations of remaining COPC, are shown on Figure 3. As discussed in the FS (AMEC, 2011a) and Section 3.1 of this document, the City of Vernon H&EC issued a closure letter to Alcoa in 1999 with the stipulation that Alcoa would continue to maintain responsibility for the Stoddard solvent-impacted soil. The letter also stated that further review or determinations may be necessary if new information related to environmental conditions at the Site is found (City of Vernon, 1999).

4.2 ABOVE-GRADE FACILITY DEMOLITION

Facility above-grade hazardous materials abatement and demolition work were completed at the Site in November 2006 by Pechiney under the direction of the City of Vernon H&EC. The work included removal and recycling or disposal of all above-ground building structures. The concrete building slabs (including those impacted by PCBs) and surrounding pavements were not removed during the above-grade demolition work. Additional testing of the concrete slabs for PCB has been conducted and was summarized earlier in Sections 3.2.3 and 3.4. These features remain in-place and will be removed as part of the below-grade demolition work described in this RAP. A summary of the above-grade demolition work is included in the Above Grade Demolition Completion Report dated December 26, 2006 (Geomatrix, 2006d).

5.0 SUMMARY OF SITE RISKS AND SITE-SPECIFIC REMEDIATION GOALS

As part of the FS for the Site (AMEC, 2011a), and pursuant to NCP 40 CFR 300.430(d)(1) and DTSC guidance and policy, AMEC conducted a screening-level HHRA to evaluate the potential human health risks associated with exposures to COPCs at the Site. This screening-level HHRA was conducted for individual "Phase areas" at the Site (Phase I through Phase VI), that were developed to facilitate future below-grade demolition work and the anticipated plans for future site use(s); which may include the construction and operation of a power plant and/or commercial/industrial facilities. Based on the results of the screening-level HHRA, COCs were identified, and site-specific risk-based and other remediation goals (collectively referred to herein as site-specific remediation goals) were proposed to address COC concentrations (AMEC, 2011a). The HHRA, identification of COCs, and development of site-specific remediation goals are summarized in this section.

5.1 EXPOSURE POPULATIONS AND PATHWAYS

Potential risks were evaluated for human receptors under current and hypothetical future land use scenarios. Ecological receptors were not evaluated because the Site and surrounding areas are highly industrialized, providing poor quality habitat for such receptors. Furthermore, U.S. Fish and Wildlife Service determined the Site was not located within the vicinity of any federally listed species, their designated critical habitat, or other Federal trust resources under their jurisdiction (February 1, 2010, email communication with William B. Miller of the U.S. Fish and Wildlife Service).

Human receptors were identified based on anticipated plans for future site use(s); there is no current use of the Vernon Facility. Because the property is being purchased by the City of Vernon for commercial/industrial use, potential future receptors at the Site include outdoor or indoor commercial/industrial workers and construction workers involved in future construction and grading work at the Site. The construction worker receptor is assumed to spend 100 percent of his time outdoors and addresses potential exposure of future short-term utility maintenance workers. No other land use (i.e., residential) is reasonably anticipated for the Site given that a deed covenant is proposed to be issued for the property restricting zoning and use of the Site to commercial/industrial purposes. Furthermore, the City of Vernon zoning laws prohibit new residential development within the City of Vernon. Commercial/industrial workers at the adjacent or nearby facilities and short-term utility maintenance workers were considered potential off-site receptors.

On site, the exposure pathways considered potentially complete for COPCs in soil for both outdoor commercial/industrial workers and construction workers and evaluated in the HHRA include:

- incidental ingestion of soil;
- dermal contact with soil;
- inhalation of soil particulates in ambient air; and
- inhalation of VOCs in ambient air (released from soil, soil vapor, or groundwater).

For the soil pathways, exposure was only considered potentially complete for the upper 15 feet of soil. Exposure also was considered potentially complete for the soil pathways to PCBs in concrete, because on-site concrete may be crushed and reused as fill soil in excavations and foundation removal areas. Finally, exposure also was considered potentially complete for the volatile COPCs in soil, soil vapor, or groundwater via inhalation of these compounds in ambient air for outdoor commercial/industrial workers and construction workers and via inhalation of these compounds in indoor air for indoor commercial/industrial workers. Because soil vapor data are considered to be more appropriate than soil data for evaluating potential vapor exposure, soil vapor samples collected in each Phase area of the Site (except for the Phase VI area where VOCs were not detected in soil) were used instead of soil data to evaluate potential vapor movement to air and inhalation exposure. Potential vapor movement of VOCs in groundwater to indoor air was evaluated separately to differentiate vadose zone from groundwater impacts.

On-site use of groundwater found in the first water-bearing unit (interpreted to be the upper portion of the Exposition aquifer) will be restricted as part of the land use deed covenant to be issued for the Site. Although groundwater from the first water-bearing unit is not currently used on or off site for potable supply (according to the City of Vernon H&EC, groundwater is produced off site from the Jefferson, Lynwood, Silverado, and Sunnyside aquifers from depths of approximately 450 to 1400 feet bgs), the RWQCB Basin Plan (RWQCB, 1994) designated groundwater in the Site vicinity for beneficial use. Therefore, potential exposure to impacted site groundwater found in the upper portion of the Exposition aquifer was evaluated. Furthermore, the potential threat of COPC movement from soil or concrete to groundwater was also evaluated.

Off-site exposure to COPCs in on-site soil was considered potentially complete for outdoor commercial/industrial workers and utility maintenance workers through inhalation of particulates and VOCs in ambient air. Exposure may also be potentially complete for off-site indoor commercial/industrial workers to VOCs moving from on-site groundwater or soil vapor into off-site indoor air. However, for COPCs detected in on-site soil, soil vapor, or groundwater, the evaluation of on-site exposures was assumed to be protective of off-site exposures. Potential off-site exposure to site-related COPCs in soil vapor at the intersection of Fruitland and Boyle Avenues was evaluated separately.

5.2 Risk Evaluation

Potential human health risks were evaluated using risk-based screening levels (RBSLs) developed using the methodology presented by the Office of Environmental Health Hazard Assessment (OEHHA) for California Human Health Screening Levels (OEHHA, 2005), and exposure parameters recommended by the DTSC (DTSC, 2005), as well as other recent OEHHA and DTSC guidance documents (OEHHA, 2009; DTSC, 2009). Potential use of groundwater was evaluated using available State or Federal maximum contaminant levels (MCLs) instead of RBSLs.

Risks from exposure to COPCs in soil and soil vapor were evaluated independently for each Phase area by comparing maximum chemical concentrations to the RBSLs. Potential vapor intrusion risks from VOCs in groundwater were evaluated for the entire Site by comparing site-wide maximum chemical concentrations in groundwater to RBSLs. Predicted lifetime excess cancer risks and non-cancer hazard quotients (HQs) were calculated from the ratios of concentrations to RBSLs, with cumulative effects from exposure to multiple chemicals evaluated by summing the chemical-specific cancer risks or HQs by exposure medium, and then summing across all media.

Potential exposure to PCBs in crushed concrete and COPCs (TCE and PCE) in off-site soil vapor, and the potential use of groundwater were evaluated separately. Potential exposure to PCBs in crushed concrete was evaluated for each Phase area by comparing maximum concrete concentrations to the RBSLs for soil. Potential exposure to TCE and PCE in off-site soil vapor (at the intersection of Fruitland and Boyle Avenues) was evaluated by comparing detected soil vapor concentrations to the indoor commercial/industrial worker RBSLs. Finally, the potential use of groundwater was evaluated by comparing site-wide maximum detected concentrations in groundwater samples from the first water-bearing unit to MCLs. In addition, potential impacts to groundwater from COPCs in soil and concrete (i.e., through leaching) were evaluated by comparing detected concentrations in soil to RWQCB or U.S. EPA Region IX groundwater protection criteria, and then developing site-specific screening levels for the COPCs above these criteria or for which the initial screening levels were not available.

The screening-level HHRA resulted in the following predicted lifetime excess cancer risks and noncancer hazard indices (HIs; the sum of chemical- and medium-specific HQs) for indoor commercial/industrial worker; outdoor commercial/industrial worker, and construction worker exposure to COPCs in soil and soil vapor in the upper 15 feet of the vadose zone.

Area	Cancer Risks			Noncancer HIs		
	Indoor C/I[1] Worker	Outdoor C/I-Worker	Construction Worker	Indoor C/I Worker	Outdoor C/I Worker	Construction Worker
Phase I	**4E-04**	**2E-03**	**3E-04**	**2**	0.02	0.2
Phase II	6E-07	**4E-03**	**6E-04**	0.004	**3**	**10**
Phase IIIa	--[2]	1E-04	2E-05	--[2]	1	**7**
Phase IIIb	3E-07	3E-07	5E-08	**53**	1	**4**
Phase IV	3E-07	1E-04	2E-05	**38**	**2**	**18**
Phase V	1E-07	5E-10	2E-08	0.002	0.003	0.03
Phase VI	--[2]	6E-05	1E-05	--[2]	0.4	**5**

Notes:

Cancer risks (greater than 1 x 10^{-4}) and HIs (greater than 1) above the ranges considered acceptable by regulatory agencies are **bold**.

1. Commercial/Industrial (C/I)
2. No volatile organic compounds were detected in soil or soil vapor in the Phase IIIa or Phase VI areas.

As presented in the table above, for cumulative soil and soil vapor exposures, the predicted lifetime excess cancer risks for the indoor commercial/industrial worker in the Phase I area; the outdoor commercial/industrial worker in the Phase I and Phase II areas; and the construction worker in the Phase I and Phase II areas are above the risk management range. The other cancer risks estimated were either within or below this risk management range. The maximum predicted noncancer HIs for the indoor commercial/industrial worker in the Phase I, Phase IIIb, and Phase IV areas; the outdoor commercial/industrial worker in the Phase II and Phase IV areas; and the construction worker in the Phase II, Phase IIIa, Phase IIIb, Phase IV, and Phase VI areas are above the acceptable range for noncarcinogenic effects (less than or equal to 1). The other HIs estimated for cumulative soil and soil vapor exposures were all at or below 1, with the majority being well below 1. In summary, maximum concentrations of chemicals resulted in risks or hazard indexes above target levels in the Phase I, Phase II, Phase IIIa, Phase IIIb, Phase IV, and Phase VI areas for one or more receptors.

The results of the independent screening of PCBs in concrete, TCE, and PCE in off-site soil vapor, and COPCs in site groundwater are summarized as follows.

- Detected concentrations of Aroclor mixtures in concrete were found to exceed their respective RBSLs in the following Phase areas:
    - Phase I Area: Concentrations of Aroclor-1248, -1254, and -1260 were found to exceed the outdoor commercial/industrial worker and construction worker cancer-based RBSLs (0.53 and 3.5 mg/kg, respectively). Concentrations of Aroclor-1254 were also found to exceed the construction worker noncancer-based RBSL (2.0 mg/kg).
    - Phase II Area: Concentrations of Aroclor-1248 and -1260 were found to exceed the outdoor commercial/industrial worker and construction worker cancer-based RBSLs (0.53 and 3.5 mg/kg, respectively).
    - Phase IV Area: One detected concentration of Aroclor-1254 was found to exceed the outdoor commercial/industrial worker cancer-based RBSL (0.53 mg/kg).
- Detected concentrations of PCE and TCE in off-site soil vapor were found to exceed the indoor commercial/industrial worker cancer-based RBSLs (2.2 µg/L and 6.3 µg/L, respectively).
- Detected concentrations of benzene, chloroform, 1,2-DCA, dichloromethane, and TCE in site groundwater were found to exceed their respective MCLs.

5.3 IDENTIFICATION OF COCS

The COPCs in soil or soil vapor that individually contributed cancer risk levels of at least 1×10^{-6} or HQs of at least 1 in the human health exposure evaluation and were identified as COCs include:

- PCB mixtures Aroclor-1232, Aroclor-1248, Aroclor-1254, and Aroclor-1260 in soil;
- arsenic in soil;
- TPH as c6-c10 hydrocarbons in soil; and

- chloroform, PCE, TCE, TPH as Stoddard solvent, 1,2,4-trimethylbenzene (1,2,4-TMB), and 1,3,5 trimethylbenzene (1,3,5-TMB) in soil vapor.

With concentrations of Aroclor-1248, Aroclor-1254, and Aroclor-1260 in concrete in the Phase I, Phase II, and Phase IV areas exceeding RBSLs, these PCB mixtures were also identified as COCs in concrete. Additional COPCs in soil were identified as exceeding the site-specific soil screening levels for the protection of groundwater and were thus identified as COCs: the BTEX compounds, 1,2 DCA, PCE, TCE, TPH as specific carbon ranges (c5-c10, c6-c10, c7-c12, c10-c20, c10-c28, and c21 c28), and TPH as Stoddard solvent. Finally, the COPCs in groundwater that exceeded their respective MCLs were identified as COCs: benzene, chloroform, 1,2-DCA, dichloromethane (i.e., methylene chloride), and TCE. With the exception of dichloromethane, these COCs were detected in groundwater as recent as 2006. No additional COPCs in groundwater were identified as COCs based on the screening of site-wide maximum detected groundwater concentrations against vapor intrusion RBSLs. Potential vapor intrusion risks from VOCs in groundwater were below the cumulative target cancer risk level and target HI proposed for the Site (10^{-5} and 1, respectively).

5.4 SUMMARY OF SITE-SPECIFIC REMEDIATION GOALS

Site-specific remediation goals were established for COCs in soil vapor, soil, and concrete at the Site under various future land use scenarios (e.g., commercial/industrial land use). Development of these site-specific remediation goals is described in detail in Section 5.2 of the FS (AMEC, 2011a). The resulting site-specific remediation goals, with explanations provided for how each value was established, are provided in Tables 1A, 1B, and 1C. In summary, the site-specific remediation goals are as follows:

Remediation Goals Established for COCs in Shallow Soil Vapor – for potential future commercial/industrial indoor air exposure (Table 1A) follow.

1. VOCs in shallow soil vapor (at 5 and 15 feet bgs):
    - chloroform – **6.7 µg/L**
    - PCE – **7.3 µg/L**
    - TCE – **21 µg/L**
    - TPH as Stoddard solvent – **500 µg/L**
    - 1,2,4-TMB – **12.3 µg/L**
    - 1,3,5-TMB – **10.7 µg/L**

Remediation Goals Established for COCs in Soil and Concrete – for future commercial/industrial use scenarios (Table 1B) follow.

1. PCBs in Shallow Soil (0 to 15 feet bgs):
   - Aroclor-1254 – **2.0 mg/kg;**
   - Total Aroclors – **3.5 mg/kg** for soil that may be left exposed at the surface (0 to 5 feet bgs); and
   - Total Aroclors – **23 mg/kg** for subsurface soil (5 to 15 feet bgs) that only construction workers may come into contact with during excavation, grading, etc. (and that would remain at 5 to 15 feet bgs).
2. PCBs in Concrete:
   - Total Aroclors – **3.5 mg/kg**
3. Metals in Shallow Soil (0 to 15 feet bgs):
   - Arsenic – **10 mg/kg**
4. TPH in Shallow and Deeper Soil (surface to groundwater, at approximately 150 feet bgs).
   - c5-c10 hydrocarbons, c6-c10 hydrocarbons, c7-c12 hydrocarbons, and TPH as Stoddard solvent – **500 mg/kg** (gasoline range hydrocarbons);
   - c10-c20 hydrocarbons and c10-c28 hydrocarbons – **1,000 mg/kg** (diesel range hydrocarbons); and
   - c21-c28 hydrocarbons – **10,000 mg/kg** (residual fuel range hydrocarbons)

VOCs in Shallow and Deeper Soil (surface to groundwater, at approximately 150 feet bgs) – depth-specific remediation goals for TCE, PCE, BTEX, and 1,2-DCA are presented in Table 1C.

Boring or sample locations with matrix sample concentrations above the site-specific remediation goals are shown on Figure 9 of the FS (AMEC, 2011a).

Remediation goals were not established for the COCs identified in groundwater. A monitored natural attenuation (MNA) remedial approach will be applied to groundwater at the Site. As required by DTSC, an additional groundwater monitoring well will be installed in the northwest corner of the Site to support the MNA approach. This is discussed further in the FS.

6.0 EVALUATION OF ALTERNATIVES

The following technologies were retained in the FS and further considered and evaluated in detail.

- No action;
- Excavation and off-site landfill disposal for surface and shallow COC-impacted soil and deep VOC-impacted soil;
- In situ stabilization of shallow metals-impacted soil, Stoddard solvent-impacted soil and PCB-impacted soil;
- SVE for shallow and deep VOC-impacted soil;
- SVE and bioventing for shallow and deep Stoddard solvent-impacted soil; and
- Demolition and disposal of PCB-impacted concrete.

These technologies were combined in the FS into potential alternatives for mitigating COC-impacted areas at the Site and are further evaluated in Section 6.2.

6.1 EVALUATION PROCESS

The Health and Safety Code section 25356.1(d) requires that remedy evaluations be based on requirements contained within the NCP 40 CFR 300.430. The NCP identifies evaluation criteria (also known as balancing or evaluation criteria) to be used in the development and scoping of remedial alternatives to provide a basis for comparison using additional, more detailed criteria, referred to as evaluation criteria. The criteria include those developed by the U.S. EPA in the NCP 40 CFR 300.430(a)(1)(iii) as modified by the State of California. All nine balancing criteria are used in this RAP (Threshold Criteria, Primary Balancing Criteria, and Modifying Criteria). These criteria are further described below.

6.1.1 Evaluation Criteria

NCP-based evaluation criteria are described below.

- <u>Overall protection of human health and the environment</u> [40 CFR 300.430(e)(9)(iii)(A)]: Evaluates if the alternative provides adequate protection and if the risks posed through each pathway are controlled, reduced or eliminated; and how the remedy achieves, maintains, or supports protection of human health and the environment.
- <u>Compliance with State and Federal requirements</u> [40 CFR 300.430(e)(9)(iii)(B)]: Evaluates how the alternative complies with applicable federal/state/local requirements and guidelines.

- Long-term Effectiveness [40 CFR 300.430(e)(9)(iii)(C)]: Refers to the ability of the alternative to maintain long-term reliable protection of human health and the environment over time, after remediation goals have been met, and identify the conditions that may remain at the Site after the remedy objectives have been met. Evaluation of the alternatives will also include factors such as treatment residuals.

- Reduction of Toxicity, Mobility, or Volume through Treatment [40 CFR 300.430(e)(9)(iii)(D)]: An evaluation of alternatives using this criterion will define the anticipated performance of the specific treatment technology. Refers to the ability of the remedy to reduce the toxicity, mobility and volume of COCs, the type and quantity of treatment residuals that will remain, and the degree to which the treatment will be irreversible.

- Cost [40 CFR 300.430(e)(9)(iii)(G)]: This assessment will evaluate the capital and operation and maintenance (O&M) costs for each alternative. The cost estimates will be assessed as capital cost, annual O&M cost, and present worth analysis.

- Short-term effectiveness [40 CFR 300.430(e)(9)(iii)(E)]: Evaluates the period of time necessary to implement the remedy, and identifies any adverse impact on the community, protection of workers, and potential environmental impacts that may arise during the implementation of the remedy, until the remediation goals are met.

- Implementability [40 CFR 300.430(e)(9)(iii)(F)]: Refers to the technical and administrative feasibility of implementing an alternative. Factors to be considered include construction and operation, monitoring duration considerations, required permits, and availability of necessary services and materials.

- Regulatory Agency Acceptance [40 CFR 300.430(e)(9)(iii)(H)]: Indicates whether the applicable regulatory agencies, after their review of the information, are in agreement with the preferred alternative.

- Community Acceptance [40 CFR 300.430(e)(9)(iii)(I)]: Indicates whether or not the community has a preference with regard to the remedy and if their concerns are being met.

6.2 DESCRIPTION AND EVALUATION OF REMEDIAL ALTERNATIVES

This section describes the remedial alternatives that were retained from the evaluation performed in the FS to address each COC. These alternatives are described below and evaluated against the Evaluation Criteria presented in Section 6.1.1 and summarized in Table 2.

6.2.1 Alternative 1

No Action

Alternative 1 consists of "No Action" and is included for evaluation pursuant to NCP 40 CFR 300.430(e)(6) and retained for comparison purposes. No below-grade demolition or soil remediation would be performed. "No Action" is not a viable alternative.

6.2.2 Alternative 2

Excavation and Disposal of COC-Impacted Soil and Demolition and Disposal of PCB Impacted Concrete

Alternative 2 consists of excavation and off-site disposal of shallow and deep COC-impacted soil (metals, PCBs, Stoddard solvent, and VOCs) to depths of approximately 8 feet bgs for metals, 12 feet bgs for PCBs, and 45 to 50 feet bgs for VOCs and Stoddard solvent, respectively. Excavation will require installation of shoring for sidewall stability and safety during soil removal. This alternative also includes demolition and landfill disposal of concrete slab containing PCB concentrations greater than 3.5 mg/kg. In addition, PCB-impacted concrete (greater than 1.0 mg/kg and less than 3.5 mg/kg) would be crushed and deposited on site as restricted fill material (i.e., on site disposal) and covered with an interim cap consisting of a visual identifier layer and a minimum of 12-inches of clean crushed concrete (unrestricted fill material). Non-PCB-impacted concrete (less than or equal to 1.0 mg/kg) would be crushed and reused on site as unrestricted fill material. A land use covenant that incorporates an operation and maintenance (O&M) plan and soil management plan would also be included in this alternative.

6.2.3 Alternative 3

Excavation and Disposal of Shallow COC-Impacted Soil, SVE for Shallow and Deep VOC-Impacted Soil, SVE and Bioventing for Shallow and Deep Stoddard Solvent-Impacted Soil, and Demolition and Disposal of PCB-Impacted Concrete

Alternative 3 consists of excavation and off-site disposal of shallow COC-impacted soil (PCBs and metals) to depths of approximately 15 feet bgs. Shallow (up to 50 feet bgs) and deep (up to 90 feet bgs) VOC-impacted soil would be mitigated using SVE. Shallow (up to 50 feet bgs) Stoddard solvent-impacted soil would be mitigated using sequential treatment consisting initially of SVE, followed by longer term bioventing. Deeper soils (at depths greater than 15 feet) impacted with PCBs above the remediation goal would be left in place and covered with a physical barrier at depth. The physical barrier would consist of 6-inches of cement concrete. This alternative also includes demolition and landfill disposal of PCB-impacted concrete slabs with PCB concentrations greater than 3.5 mg/kg. In addition, PCB-impacted concrete (greater than 1.0 mg/kg and less than 3.5 mg/kg) would be crushed and deposited on site as restricted fill material (i.e., on site disposal) and covered with an interim cap consisting of a visual identifier layer and a minimum of 12-inches of cleans crushed concrete (unrestricted fill material). Non-PCB-impacted concrete (less than or equal to 1.0 mg/kg) would be crushed and reused on site as unrestricted fill material. A land use covenant that incorporates an O&M plan and soil management plan would also be included in this alternative.

6.2.4 Alternative 4

In Situ Stabilization of Shallow PCB/Metals-Impacted Soil and Deep Stoddard Solvent-Impacted Soil, SVE for Shallow and Deep VOC-Impacted Soil, and Demolition and Disposal of PCB-Impacted Concrete

Alternative 4 consists of in situ stabilization (ISS) of shallow PCB- and metals-impacted soil and deep Stoddard solvent-impacted soil, using a cement-based additive to depths of approximately 15 feet bgs for PCB- and metals-impacted soil and approximately 50 feet for Stoddard solvent-impacted soil. Shallow (up to 50 feet bgs) and deep (up to 90 feet bgs) VOC-impacted soil would be mitigated using SVE. This alternative also includes demolition and off-site disposal of concrete slabs containing PCB concentrations greater than 3.5 mg/kg. In addition, PCB-impacted concrete (greater than 1.0 mg/kg and less than 3.5 mg/kg) would be crushed and deposited on site as restricted fill material (i.e., on-site disposal) and covered with an interim cap consisting of a visual identifier layer and a minimum of 12 inches of clean, crushed concrete (unrestricted fill material). Non-PCB-impacted concrete (less than or equal to 1.0 mg/kg) would be crushed and reused on site as unrestricted fill material. A land use covenant that incorporates an O&M plan and soil management would also be included in this alternative.

6.3 Summary Analysis of Alternatives against the Nine Criteria

The four alternatives are analyzed below using the nine evaluation criteria.

6.3.1 Overall Protection of Human Health and the Environment

All of the alternatives, with the exception of the "No Action" alternative, meet this criterion by mitigating shallow COC-impacted soils and PCB-impacted concrete containing COC concentrations above the site-specific remediation goals, and eliminating source areas that could potentially impact groundwater.

6.3.2 Compliance with Applicable Requirements

All of the alternatives, with the exception of the "No Action" alternative, meet this criterion. Because the "No Action" alternative would not be protective of human health and the environment and would not meet the remediation goals for the Site, Alternative 1 will not be discussed further in the criteria analysis below.

6.3.3 Long-Term Effectiveness and Permanence

All of the alternatives would eliminate human exposure pathways between future receptors and soil, soil vapor, recycled concrete, and airborne dust. In addition, the SVE with bioventing as included in Alternative 3 and SVE as included in Alternative 4, are considered presumptive remedies, are minimally invasive, and can achieve site-specific remediation goals for shallow and deeper VOC- and Stoddard solvent-impacted soil.

6.3.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternatives 2 and 3 would reduce the toxicity, mobility, and volume of COC-impacted soil and PCB-impacted concrete. Alternative 4 would reduce the toxicity, mobility, and volume of PCB-impacted concrete and deeper VOC- and Stoddard solvent-impacted soil. Alternative 4 would also reduce the mobility of shallow COC-impacted soils, but volume and toxicity would not be significantly reduced by ISS treatment.

6.3.5 Cost

Costs for the excavation components in Alternatives 2 and 3 were based on an excavation rate of 500 cubic yards per day and confirmation sample rate of one sample per 200 cubic yards of excavated material. Shoring costs are included in all proposed excavation areas greater than 10 feet. Waste management costs associated with landfill disposal of metals, VOCs, and Stoddard solvent impacted soils were estimated assuming that 90 percent of the waste is classified as a non-hazardous waste and 10 percent of the waste is classified as a hazardous waste. Waste management costs associated with landfill disposal of PCB impacted soils were estimated assuming that 30 percent of the soil waste is classified as a non-TSCA waste and 70 percent of the soil waste is classified as a TSCA waste. Average thickness of the PCB-impacted concrete slabs was assumed to be 12 inches.

Costs for SVE for VOC-impacted soil in Alternatives 3 and 4 were based on rental of a minimum 1,000 cubic feet per minute (cfm) South Coast Air Quality Management District (SCAQMD)-permitted system operating for over a three year period. Bioventing costs for the Stoddard solvent impacted soil under Alternative 3 include operation of a SVE system for the first 3 months of a three-year period followed by operation of a pulsed air injection system over a the remainder of the three-year period.

Costs for soil stabilization in Alternative 4 are based on a stabilization rate of 300 cubic yards per day, maximum stabilization depth of 50 feet bgs, and a stockpile confirmation sample rate of one sample per 200 cubic yards. Cement-mixing-additives are assumed to be 10 percent of the stabilization material for cost estimating purposes. Cost assumes 20 percent of the mixed volume requires off-site disposal. Waste management costs associated with landfill disposal were estimated assuming that 90 percent of the waste would be classified as a non-hazardous waste and 10 percent of the waste would be classified as a hazardous waste. Estimated total capital cost for Alternatives 2, 3 and 4 are summarized in Table 2 and additional cost detail is provided in Appendix A.

6.3.6 Short-Term Effectiveness

All of the alternatives will reduce risk to receptors and the environment if appropriate personal protective equipment (PPE) is worn by site workers; and if dust, noise and odor controls are implemented. Alternative 2 would have the greatest short-term impacts on the community and the workers due to potential air emissions produced during large-scale excavation activities. Alternatives 3 and 4 would have the least short-term impacts (with Alternative 3 being the least) on Site workers because deeper soil impacts would be mitigated using less invasive in-situ remedial technologies.

6.3.7 Implementability

The technologies employed in Alternatives 2, 3 and 4 are reliable and have proven effective in previous field applications. Implementation is relatively straightforward using commercially available materials and equipment.

Additionally, the SVE and bioventing technologies associated with Alternatives 3 and 4 are considered presumptive remedies and have been demonstrated as effective on numerous other sites impacted by organic COCs similar to those present at the Site. Previous site-specific bench-scale treatability studies performed by Alcoa also demonstrated that the Stoddard solvent-impacted soils are amenable to bioventing as contained in Alternative 3. SCAQMD permits must be obtained for operation of the SVE systems for both VOC- and Stoddard solvent-impacted soils along with a monitoring and reporting program after system start-up.

Soil stabilization as described in Alternative 4 requires a bench-scale mix design test and mobilization of a crawler-mounted large diameter auger drilling rig. Shoring or other slope stability controls are required for all remedy components that include soil excavations greater than four feet deep.

7.0 PREFERRED REMEDIAL ALTERNATIVE

Alternative 3, which consists of excavation and disposal of shallow COC-impacted soil, SVE for shallow and deep VOC-impacted soil, SVE and bioventing for shallow and deep Stoddard solvent-impacted soil, and demolition and disposal of PCB-impacted concrete, is the preferred remedial alternative described in Section 6.2.3. Alternative 3 is selected because it satisfies the balancing criteria discussed above, as required by Health and Safety Code section 25356.1(d) and the NCP, and will not require extensive soil excavation and off-site disposal. Alternative 3 is preferred to Alternative 4 because Alternative 3 will reduce the toxicity, mobility, and volume of COC-impacted soil to a greater extent than Alternative 4. Alternative 3 consists of soil excavation and disposal and SVE and bioventing in a balanced mitigation strategy that is the most cost-effective, is minimally invasive, and is protective of human health and the environment. Implementation of the remediation components associated with Alternative 3 is described below.

7.1 PCB-IMPACTED CONCRETE REMEDIAL ACTION IMPLEMENTATION

The preferred remedial approach for PCB-impacted concrete is demolition and disposal at an offsite landfill facility. This portion of the remedy will be implemented in conjunction with below-grade demolition of surface slabs and pavements. Based on the results of the screening HHRA and attenuation modeling for protection of groundwater, a site-specific PCB remediation goal of 3.5 mg/kg has been proposed to be applied as the crushed concrete reuse criterion (on-site disposal). Concrete that exceeds the remediation goal cannot be reused on site and will be removed and disposed off site during below-grade demolition to offsite landfill facilities designated to receive TSCA-regulated PCB-containing wastes. Concrete slabs with PCB concentrations greater than 1 mg/kg and less than 3.5 mg/kg will be crushed on site and deposited on site with restrictions as excavation backfill. This material will be placed in a localized area (former Building 104) at depths greater than 5 feet bgs, demarcated with a visual identifier layer, then covered with crushed concrete containing less than 1 mg/kg of PCBs (interim cap), as required by U.S. EPA. Concrete slabs with PCB concentrations less than or equal to 1 mg/kg will be crushed on site and reused without restriction at the Site as fill during grading activities. Figure 4 shows concrete sampling concentrations and locations, and defines areas where PCB concentrations in concrete exceed 1 mg/kg, 3.5 mg/kg, and 50 mg/kg.

7.1.1 Site Preparation

PCB-impacted concrete will be demarcated at the Site by painting a "cut line" on the slab to identify those areas previously delineated by slab coring and laboratory analytical testing. The cut lines will encircle areas previously identified to contain PCB concentrations greater than 1.0 mg/kg, greater than 3.5 mg/kg, and greater than 50 mg/kg.

7.1.2 Slab Removal and Stockpiling

Slabs will be saw-cut or broken along demarcation lines to facilitate removal using construction equipment. PCB-impacted slabs will be removed, sized for handling, and either temporarily stockpiled on site in separate piles or bins based on concentrations prior to disposal, or direct-loaded into hauling trucks for landfill disposal. All PCB-impacted concrete wastes slated for landfill disposal will be shipped off site within 30 days of generation pursuant to 40 CFR 761.65(c)(1).

Slab areas where PCB concentrations exceed 50 mg/kg will be direct-loaded into bins or hauling trucks for off-site landfill disposal as a TSCA PCB hazardous waste. Concrete containing PCBs with concentrations greater than 3.5 mg/kg will be direct-loaded for off-Site landfill disposal as a TSCA, bulk PCB remediation waste. Concrete with PCB concentrations greater than 1 mg/kg but less than 3.5 mg/kg (restricted use fill) will either be removed and stockpiled on site pursuant to 40 CFR 761.65(c)9 prior to crushing and reuse as restricted fill; or removed and placed directly into an excavation as restricted fill.

In areas with PCB-impacted concrete, the concrete slabs will be observed during removal for multiple layers of concrete and visible staining. Concrete slabs or below-grade structures exhibiting visual signs of staining will be segregated for sampling and analysis for PCBs. During periods of inactivity, PCB-impacted concrete stockpiles will be covered to control dispersal of material via wind or runoff pursuant to 40 CFR 761.65(c)9. Contractor stockpiling activities will be performed pursuant to Section 02114 of the Below Grade Demolition and Soil Excavation Technical Specifications (Technical Specifications) (Appendix B).

Perimeter air monitoring will be conducted during slab removal and stockpiling as described in Section 7.2.4.

7.1.3 Soil Sampling Beneath PCB-Impacted Concrete

In areas where soil verification and characterization data does not already exist beneath newly identified PCB-impacted concrete slabs with PCB concentrations above 3.5 mg/kg, additional in-situ soil characterization samples will be collected after slab removal is complete to determine the concentration at which PCBs may be present. The frequency by which these soil samples will be collected will be selected in the field using the sampling frequency provided below.

Concrete Slab Areas (in feet)	Grid Spacing	Additional Samples	Estimated Number of Samples
Horizontal dimensions up to approximately 10 by 10 feet	None	– 1 soil sample at the center of the exposed soil area, or directly beneath the location where the concrete core sample exhibited the highest PCB concentration	1
Horizontal dimensions up to approximately 20 by 20 feet	Grid divided into 2 equal parts	– 2 samples; one from the center of each grid part – 1 sample; directly beneath the location where the concrete core sample exhibited the highest PCB concentration	3
Horizontal dimensions up to approximately 50 by 50 feet	Grid divided into 4 equal parts	– 4 samples; one from the center of each grid part – 1 sample; directly beneath the location where the concrete core sample exhibited the highest PCB concentration	5

The actual number of confirmation soil samples collected from beneath the PCB-impacted slabs will be selected in the field based on the size of the area and the location of adjacent footings and below-grade structures. These confirmation samples will be collected using the procedures described in Appendix B of the Quality Assurance Project Plan (QAPP) (Geomatrix, 2007), and the SAP (AMEC, 2010a).

Additional PCB-impacted soil found at concentrations above the site-specific remediation goals for soil (at depth between 0 and 15 feet bgs) will be removed and verification sampling will be implemented as described in Section 7.2.7.

7.1.4 Concrete Profiling, Transportation, and Disposal

Concrete characterization data or additional concrete sampling data collected prior to or during below-grade demolition will be used to create a waste disposal profile at a facility permitted to receive PCB-impacted wastes. The appropriate TSCA notification of PCB activity will be filed with the U.S. EPA, as required.

Concrete containing total PCBs greater than 1 mg/kg are considered bulk PCB remediation waste. Concrete with total PCBs greater than 1 mg/kg but less than 3.5 mg/kg (concrete remediation goal) will be disposed on site as restricted fill in selected deeper soil excavation areas (greater than 5 feet bgs) then covered with an interim cap pursuant to Section 2110 of the Technical Specifications (Appendix B). Concrete containing total PCBs less than 1 mg/kg will be used as unrestricted fill on site during backfilling and grading activities.

Porous surfaces impacted with PCBs greater than 1 mg/kg, including asphalt and certain piping made of or coated with porous material shall be disposed of in accordance with 40 CFR 761.61.(a)(5)(i). Concrete containing PCBs at concentrations that exceed risk-based remediation goals (greater than 3.5 mg/kg) will also be disposed of in accordance with 40 CFR 761.61.(a)(5)(i). Any non-porous materials such as metal piping impacted with PCBs greater than 1 mg/kg, that are removed during demolition of slabs and below-grade structures, are also considered PCB remediation waste, and shall be disposed of in accordance with 40 CFR 761.61(a)(5)(i)(B)(2)(ii) and 761.61(a)(5)(i)(B)(2)(iii).

After impacted concrete and other bulk PCB remediation wastes are profiled, they will then be removed and loaded into trucks for transportation to an off-site landfill for disposal pursuant to Section 02120 of the Technical Specifications (Appendix B), and the Hazardous Materials Transportation Plan (AMEC, 2010b). All PCB-impacted concrete wastes slated for landfill disposal will be shipped off site within 30 days of generation.

Each truck load will be covered with either a tarpaulin or plastic sheeting prior to departing the jobsite. Wastes shipped off site in roll-off bins or containers will have closed tops. All truck exteriors will be inspected and cleaned of any loose soil or concrete debris that may be present on the truck exterior associated with loading activities. The contractor will take proper measures to prevent Site soil or debris from being tracked onto adjacent City right-of-ways during off-site shipment. Cleanup wastes, including non-liquid cleaning materials and PPE impacted with PCBs greater than 1 mg/kg, shall be disposed of as PCB remediation waste in accordance with 40 CFR 761.61(a)(5)(v). All loads will be properly manifested and placarded.

7.1.5 Decontamination of Equipment and Tools

Construction equipment and tools used during the removal and handling of PCB-impacted concrete and soil will be decontaminated prior to exiting the Site. Sampling equipment used during collection of confirmation or verification samples will be decontaminated prior to first use and between sampling locations (U.S. EPA, 2008).

Working surfaces that have contacted PCBs will be decontaminated with hexane using the double wash/rinse methods as defined in 40 CFR 761 Subpart S. Decontamination waste and residues will be collect, properly containerized and labeled, then disposed off site in accordance with 40 CFR 761.60. The decontamination waste will be profiled for disposal pursuant to 40 CFR 761.79(g).

7.2 SURFACE/SHALLOW COC-IMPACTED SOIL REMEDIAL ACTION IMPLEMENTATION

The preferred remedial technology for surface and shallow COC-impacted soil is excavation and off-site landfill disposal. These remedial excavation areas are shown on Figure 5. This remedy will be implemented after below-grade demolition of surface slabs and pavements, utilities and pipelines, pits, sumps, and other deeper structures is complete.

7.2.1 Groundwater Monitoring Wells

As required by DTSC, an additional groundwater monitoring well will be installed in the northwest corner of the Site to support the MNA groundwater approach. The newly installed groundwater monitoring well and the remaining three groundwater monitoring wells AOW-6, AOW-8, and AOW 9 (located in the Phase IIIb and Phase IV areas), will remain in place and protected during demolition. These wells will be used to obtain current groundwater flow direction information, and groundwater samples will be periodically monitored for VOCs and natural attenuation parameters. After the initial testing is completed, a sampling schedule and suite of analysis will be provided to DTSC for future sampling events. When required, the wells will be destroyed in accordance with applicable guidelines listed in the California Department of Water Resources Bulletin 74 81 and 74-90 upon completion of remediation of the Stoddard solvent-impacted soil and upon receipt of authorization from the DTSC.

7.2.2 Site Preparation

Site preparation includes obtaining necessary permits, implementation of storm water and dust controls, and installation of excavation shoring prior to soil removal. These tasks are further described below.

7.2.3 Storm Water Controls

Storm Water Best Management Practices will be implemented and maintained around the excavation perimeter and soil stockpiling areas pursuant to Section 01502 of the Technical Specifications (Appendix B) and the contractor's Storm Water Pollution Prevention Plan (SWPPP) (American Integrated Services, Inc., 2010).

7.2.4 Dust Controls and Perimeter Air Monitoring

Dust control measures will be implemented during soil excavation and handling (and concrete crushing activities) pursuant to Section 01501 of the Technical Specifications (Appendix B). The primary dust control measure will be the application of water sprays or mists. Site perimeter air monitoring will be conducted as described in the Revised Perimeter Air Monitoring Plan (AMEC, 2011b). The plan includes, among other things, a season-specific wind rose and a figure showing wind flow patterns in the vicinity of the Site in relation to neighboring communities. Air monitoring instruments will be located on the Site based on this information.

7.2.5 Shoring

Site preparation may require installation of shoring around the perimeter of each proposed excavation area greater than 10 feet deep pursuant to Section 02260 of the Technical Specifications (Appendix B). A Shoring Plan will be prepared by the contractor and submitted to the City for review and approval prior to actual shoring installation.

7.2.6 Excavation and Stockpiling

Soil will be excavated using a track-mounted excavator capable of removing soil to depths of greater than 15 feet bgs. Soil will be excavated to the lateral and vertical extent of known COC-impacts based on previous site characterization sampling data. Excavated soil will be staged adjacent to the excavation and then transferred to a lined and bermed temporary stockpile located on site. Contractor soil stockpiling activities will be performed pursuant to Section 02114 of the Technical Specifications (Appendix B).

7.2.7 Confirmation and Verification Sampling and Waste Profiling

Confirmation soil sampling within open excavation areas will be conducted using the procedures described in Appendix B of the QAPP (Geomatrix, 2007). Verification samples will be collected from soil removal areas with PCB impacts. Verification samples will be collected in the same manner as the confirmation samples, and will adhere to the guidelines outlined in the SAP (AMEC, 2010a).

Soil samples will also be collected from the temporary stockpile for waste profiling purposes to meet the acceptance criteria of the receiving facility, prior to off-site landfill disposal. Soil analytical testing will be performed to meet the waste profile requirements of the receiving facility.

7.2.8 Off-Site Disposal

COC-impacted soil will be loaded into trucks and shipped off site for landfill disposal pursuant to Section 02120 of the Technical Specifications (Appendix B). Each truck will be covered with either a tarpaulin or plastic sheeting prior to departing the jobsite, and all truck exteriors will be inspected and cleaned of any loose soil that may be present on the truck exterior after loading. The contractor will take proper measures to prevent Site soil from being tracked onto adjacent City right-of-ways during off-site shipment. All loads will be properly manifested and placarded.

7.2.9 Backfilling and Grading

Excavation areas will be backfilled with crushed recycled aggregates obtained from on-site crushing of concrete demolition debris (as unrestricted fill with PCB concentrations less than or equal to 1 mg/kg). Restricted fill with PCB concentrations greater than 1 mg/kg and less than or equal to 3.5 mg/kg will be used as backfill at a designated location on site as described in Section 7.1.2. Aggregates will be crushed to the gradations provided in Section 02050 of the Technical Specifications (Appendix B), and will be backfilled and compacted pursuant to Section 02351 of the Technical Specifications (Appendix B).

7.2.10 Schedule for Implementation

Excavation and off-site disposal of the COC-impacted soil will be performed by the contractor during the implementation of below-grade demolition and soil excavation work. Below-grade demolition work is anticipated to start after agency approval of the RAP and completion of the public participation activities. It is anticipated that the below-grade demolition and soil remediation work can be completed in approximately four to six months, excluding any potential weather-related delays.

7.3 Shallow and Deep VOC-Impacted Soil Remedial Action Implementation

The preferred remedial technology for shallow and deep VOC-impacted soil (containing TCE, PCE, and benzene) in the Phase I area is SVE. This remedy will be implemented upon completion of below-grade demolition associated with slab, foundation, footing, and other structure removal in the Phase I area at the Site. A network of SVE wells will be installed with well screen intervals both above and below the fine-grained soil unit present from approximately 50 to 70 feet bgs in the northern portion of the Site. SVE wells will be installed at the Site within the area of known impacts and at other locations where VOCs were detected in soil and soil vapor at concentrations exceeding the site-specific remediation goals. Some of these SVE wells will be placed adjacent to the northwestern property boundary to facilitate coverage of the soil vapor impacts observed directly adjacent to the Site on Fruitland Avenue as shown on Figures 6 and 7. Soil cuttings generated during well installation work will be contained as investigation-derived waste for profiling and off-site disposal. Specific details regarding the SVE system and associated remediation equipment are provided below.

7.3.1 Site Preparation

After completion of below-grade demolition and limited soil excavation work related to footings and foundations removal in the Phase I area, the area will be re-graded and compacted. The area will be topographically lower than previous Site conditions prior to foundation and soil removal. A four- to six-inch thick layer of crushed recycled aggregates, obtained from the on-site crushing of clean concrete demolition debris, will be spread across the Phase I area to provide a suitable working surface during implementation of SVE.

A three-phase, 240-volt, 200-ampere temporary electrical power service panel will be installed on a temporary power pole in the northwest corner of the Site to obtain electricity from existing power lines located along Fruitland Avenue. The temporary power pole and electrical service panel will be required to operate the SVE system, and will be located inside the existing concrete perimeter wall near the intersection of Boyle and Fruitland Avenues.

7.3.2 Well Installation

SVE wells will be installed in the Phase I area at two specific depth intervals as presented below.

SVE Well Depth	Well Screen Interval (feet bgs)	Estimated Well Radius of Influence	Well Lateral Spacing	Number of Wells
Surface to 50 feet bgs	40 to 50	60 to 75 feet	100 to 120 feet	15
Surface to 90 feet bgs	80 to 90	85 to 100 feet	200 to 240 feet	4

The approximate number of SVE wells proposed in the RAP was based on previous knowledge of radius of influence (ROI) values for similar types of lithologies observed at different sites. The shallow screen intervals are located at a depth that corresponds to the coarse-grained soils above the upper surface of the fine-grained unit observed at a depth of approximately 50 feet. This 10-foot screened interval was selected to target the upper vadose zone (between the depths of 5 to 50 feet) where impacted soil and soil vapor were observed with elevated VOC concentrations. The 10-foot screen will facilitate a larger ROI in both the horizontal and vertical directions. The deeper screen intervals are located near the approximate depths of deeper soil samples that contained elevated VOC concentrations. The top of the deeper screen interval (80 feet bgs) is approximately at the bottom of the fine-grained unit. Figures 6 and 7 provide the proposed SVE well locations, and Figure 8 contains a generalized construction diagram for the proposed SVE wells.

Prior to start-up, soil vapor samples will be collected from the SVE wells to establish baseline conditions. An evaluation of the effective area of influence will be performed at the Site after the proposed SVE well network is installed. Additional SVE wells may be added based on effective area of influence both above and below the fine-grained unit. Wellhead completions will consist of an above-ground flow-controlling ball valve and sample port for periodic soil vapor sampling and area of influence monitoring. Each SVE well will be constructed using Schedule 40 polyvinyl chloride (PVC) pipe with a 0.020-inch slot screen size, a sand filter pack surrounding the well screen, a bentonite seal, and a concrete surface seal (Figure 8).

7.3.3 Temporary Piping

SVE wells will be connected to the treatment equipment by temporary Schedule 40 PVC piping and/or flexible suction hose placed directly on the crushed recycled aggregate surface. Vapor will be conveyed to a 6-inch diameter common header line (adequate to support the combined soil vapor pressures and flow rates from each SVE well), and then to the portable SVE equipment for treatment. A process flow diagram for the proposed system is shown on Figure 9. Each vapor extraction well head will be equipped with a vacuum gauge port and a ¼-inch brass tap that may be removed for insertion of a hotwire anemometer for flow measurement. A detail of the well head piping is shown in Figure 10.

7.3.4 Treatment Equipment

The treatment equipment will consist of a trailer- or skid-mounted system with a SCAQMD permit. The equipment will include a moisture knockout drum, a blower/compressor capable of applying a vacuum of 100 inches of water and a minimum flow rate of 500 to 1,000 cfm, a minimum of two 1,000-pound vapor-phase granular activated carbon (vGAC) vessels, and associated equipment connections. A piping and instrumentation diagram for the anticipated skid-mounted treatment system is shown on Figure 11. The size and arrangement of the vGAC vessels will depend on the specific requirements of the SCAQMD permit. The moisture knockout drum will be situated upstream of the compressor/blower with the vGAC vessels configured in series and installed downstream of the compressor/blower. The system will be connected to the SVE well piping grid.

The compressor/blower will convey extracted soil vapor from the SVE well field to the common header line, through the moisture knockout drum, and then to the vGAC vessels. Moisture that collects in the knockout drum will be manually pumped or transferred to and stored in 55 gallon capacity Department of Transportation-approved drums. The drums will be characterized and transported off site for disposal on an as needed basis. Treated soil vapors conveyed through the vGAC vessels will be discharged to the atmosphere in compliance with SCAQMD permit conditions.

7.3.5 Startup Testing

Startup testing will be performed to verify the functionality of the equipment and collect information to document the area of influence of the SVE system. Functionality testing will include a diagnostic check of each component including, but not limited to, the knockout drum controls, compressor/blower operation, emergency shutdown controls, high temperature and level alarms, and leaks in piping.

Once the system has passed the functionality test, the system will be started and data will be collected for the purpose of documenting the area of influence. Testing will focus on two SVE wells, while the remaining SVE wells will be used as monitoring points during the area of influence test. The two SVE wells will be tested for approximately 6 hours using a step-vacuum test. The vacuum applied to each extraction well will be varied every 2 hours based on the approximate schedule summarized in Table 3.

Following startup and area of influence testing, a report documenting the results will be submitted to the DTSC. The report will include as-built diagrams, summary of the installation and startup activities, data collected during area of influence testing, and vacuum versus flow relations for the tested wells. In addition, the report will document the plan for O&M and monitoring of the SVE system including a procedure for rebound testing, steps for closure, and copies of air permits.

7.3.5.1 Soil Vapor Sampling

Soil vapor samples will be collected from the SVE wells at the frequency shown in Table 3. These samples will be collected in Tedlar bags using a vacuum sample box and analyzed in the field for VOCs using a photoionization detector (PID). Prior to collecting soil vapor samples from the SVE wells, a volume equal to approximately two times the casing volume will be purged. The soil vapor samples collected during testing will be analyzed for total hydrocarbons using EPA Method TO-3 and VOCs using EPA Modified Method TO-15.

7.3.5.2 Vacuum and Flow Rate Monitoring

During startup testing, vacuum at selected SVE wells, and the treatment system will be monitored with a hand-held digital manometer at the time intervals shown in Table 3. SVE wells will be sealed at the wellheads during testing by closing the isolation gate valve shown in Figure 10. A quick-disconnect port installed in the piping will be used to measure the wellhead response to the applied vacuum at each SVE well. The observed vacuums will be used in establishing the area of influence.

The flow rate from each SVE well will be recorded using a digital hot wire anemometer connected to the SVE system at the time intervals shown in Table 3. The flow rate measurements will be used to assess flow rate capacities for the SVE wells.

7.3.6 Operations, Maintenance, and Monitoring

Operation of the SVE system will begin after completing start-up testing. The system will be monitored initially by demolition observation field personnel already present on site at a minimum of twice per week during the first month of operation. Operating personnel will collect measurements that will be used to evaluate the system's overall performance and effectiveness in remediating the VOC-impacted soils. Field measurements will consist of recording system operating parameters including: hours of operation, operating temperatures, extraction flow rates, and inlet and outlet vapor concentrations for the vGAC vessels using the same methods identified in the startup testing. SVE system monitoring will be performed in compliance with the SCAQMD permit requirements or minimally on a weekly basis.

Maintenance performed during routine system inspections and/or monitoring will comply with SVE vendor and/or equipment specifications. As part of the monitoring of the system, influent and effluent concentrations will be measured using a portable organic vapor meter such as a PID, which detects and quantifies organic vapors. Results of operation monitoring will be recorded on emission monitoring logs. Influent and effluent vapor samples will be collected in a 1 liter Tedlar bag using a sample collection box and submitted to an analytical laboratory on a monthly basis for the analyses prescribed in the SCAQMD permit. Additional monitoring will be performed in accordance with the SCAQMD permit to operate.

7.3.7 Schedule for Implementation and Completion

SVE of shallow and deep VOC-impacted soil will commence after below-grade demolition and soil excavation are completed in the Phase I area. The milestone phasing and completion of work as described in Section 01110 of the Technical Specifications (Appendix B) require the contractor to complete below-grade demolition work in the Phase I area within 40 calendar days after mobilizing to the Site and installation of required temporary facilities and controls. SVE system installation and SVE operations will begin approximately four weeks after contractor completion of below grade demolition work in the Phase I area.

SVE operation will continue until commercial/industrial facility construction commences or until effluent vapor monitoring from SVE wells indicate vapor concentrations have reached asymptotic conditions. If Site construction is delayed and subsurface concentrations still warrant SVE operations beyond 12 months, a site-specific SCAQMD permit will be obtained.

If asymptotic conditions have not been reached prior to future commercial/industrial facility construction, SVE operation will be suspended until construction is complete, if necessary. After completion of construction, SVE operation will be restarted, and if needed, new SVE wells will be installed and operated until the following pre-closure requirements have been met.

1. The SVE system has targeted the zones of impacted soil on the basis of the initial design and quarterly monitoring.
2. The SVE system has been optimized based on routine monitoring and regular optimization reviews.
3. The optimized SVE system has met an asymptotic mass removal rate for the VOCs based on vapor samples collected for laboratory analysis and vapor flow measurements conducted at individual wells and/or the influent to the treatment system.

The system will then be shut down to undergo vapor rebound testing, followed by additional operations as necessary. The rebound testing process will be documented in the Startup documentation report discussed in Section 7.3.5. Post-remediation soil matrix confirmation sampling will be performed in previously defined VOC hot spot areas upon completion of rebound testing and termination of SVE operation.

While future Site development may limit physical access into certain areas, efforts will be made to obtain soil matrix samples from approximate locations consistent with previous VOC characterization sampling events in the VOC impacted areas. Approximately six soil borings will be advanced to groundwater and eight soil samples will be collected from both above and below the fine-grained unit located at a depth of approximately 50 feet bgs. These soil samples will be analyzed for VOCs using EPA Method 8260B/5035. Soil sampling results may be used to document the remaining concentrations of VOCs in soil for a deed covenant for the Site.

7.4 Shallow and Deep Stoddard Solvent-Impacted Soil Remedial Action Implementation

The preferred remedial technology for the shallow and deep Stoddard solvent-impacted soil in the Phase IIIb and Phase IV areas is SVE and bioventing. This remedy will be implemented during the below-grade demolition and soil remediation activities at the Site and prior to any subsequent redevelopment construction of other commercial/industrial facilities. Although bioventing is related to the process of SVE, and both technologies involve movement of air through the subsurface, the differences in objectives result in different design and operational requirements of the remedial systems (Leeson & Hinchee, 1996). The major distinction between these technologies is that SVE optimizes removal of low-molecular weight compounds by volatilization achieved through high rates of vapor extraction (under vacuum). SVE will be performed initially to remove the approximately 15 percent volatile fraction of COCs present in the Stoddard solvent areas. When vapor monitoring data indicate asymptotic conditions have been reached, the SVE system will be shut down and converted to a bioventing remedial process to continue the in situ remediation process of the less volatile hydrocarbon compounds remaining in the subsurface.

Bioventing optimizes biodegradation of aerobically degradable compounds using much lower air flow rates than those required for SVE systems, thus minimizing both volatilization and capital costs. The system conversion to bioventing would consist of reversing the air flow direction by injecting atmospheric air into the subsurface through the SVE piping grid and vent wells at a greatly reduced flow rate. Air injection would be achieved in a pulsed or intermittent manner, for the equivalent of approximately one day per week. Air injection rates will be modified as needed (increase or decreased) based on oxygen utilization rates.

A network of venting wells will be installed to depths of approximately 50 feet bgs in the areas where Stoddard solvent COCs exceed site-specific remediation goals. The vent wells will be used for SVE, bioventing and monitoring. Specific details regarding the SVE and bioventing system and associated remediation equipment/components are provided below.

7.4.1 Site Preparation

Existing surface slabs and below-grade footings will be left intact in the Phase IIIB and IV areas during implementation of the in situ SVE and bioventing remedy to reduce odors and dust from the Stoddard solvent-impacted areas. The existing building slab may be used as a working surface for equipment and staging materials associated with the adjacent below grade demolition work.

A three-phase, 240-volt, 100-ampere temporary electrical power service will be installed in the vicinity of the south end of former Building 112A to power the SVE and bioventing system equipment.

7.4.2 Vent Well Installation

Venting wells will be installed in the Phase III and IV area at a single depth interval as presented below.

Vent Well Depth	Well Screen Interval (feet bgs)	Well Lateral Spacing	Number of Wells
Surface to 50 feet bgs	15 to 50	60 to 120 feet	15

Figure 12 provides the locations of the proposed vent wells. Wellhead completions will consist of a flush-mount well box to contain a flow-controlling gate valve, vacuum gauge port, and a ¼-inch brass tap that may be removed for insertion of a hotwire anemometer for flow measurement. A detail of the well head piping is shown on Figure 10. Each vent well will be constructed with a 2-inch diameter Schedule 40 PVC pipe with a 0.020-inch slot screen, sand filter pack, bentonite seal and concrete surface seal. Wells installed for initial SVE operation will also be used during subsequent bioventing activities. Prior to start-up, soil vapor samples will be collected from the vent wells to establish baseline conditions. Figure 8 contains a schematic construction diagram for the proposed vent wells.

7.4.3 Well Piping

Vent wells will be connected to the treatment equipment with Schedule 40 PVC piping placed along the surface of the slab, ground surface, or in below grade trenches constructed by saw-cutting and removing surface concrete slabs along designated piping corridors. Pipe construction and installation configuration will be determined in the field to accommodate below-grade demolition work. Piping trenches may be backfilled to slab grade with a one-sack cement slurry. A process flow diagram for the proposed bioventing system is shown in Figure 12.

7.4.4 Treatment Equipment

Initial SVE operations will be performed using a trailer-mounted system in conformance with a SCAQMD Various Locations permit. The system will be similar in configuration to the SVE unit proposed to remediate shallow and deep VOC-impacted soil as described in Section 7.3. The equipment will consist of a compressor/blower, two 1000-lb vGAC vessels, moisture knockout drum, and associated equipment connections. It is anticipated that the SVE equipment will be similar to that used for the Phase I area, and the piping and instrumentation diagram for the anticipated skid-mounted treatment system is shown as Figure 11. Extracted condensate captured in the moisture knockout drum during SVE operations will be characterized and transported off site for disposal on an as-needed basis.

Bioventing equipment will consist of a separate skid-mounted system comprised of a minimum 5.0 horse power electric blower capable of injecting air up to 150 cfm at 10 pounds per square inch. The blower will be equipped with a dilution air valve and temperature probe.

Atmospheric air will be injected at low-flow rates of approximately 1 to 3 cfm per vent well in a pulsed or intermittent manner, through a common header line that connects to each well to provide oxygen to native soil microbes. No volatile exhaust gases or fugitive emissions are anticipated to be generated that would require treatment because the compressor/blower will be injecting air at a very low rate and no vent wells will be open to the atmosphere.

7.4.5 Startup Testing

Startup testing will be performed to verify the functionality of the equipment, collect information to document the area of influence of the SVE system, and perform a respirometry test to confirm the size of the bioventing system needed. Functionality testing will include a diagnostic check of each component including, but not limited to, the knockout drum controls, compressor/blower operation, emergency shutdown controls, high temperature and level alarms, and leaks in piping.

Once the system has passed the functionality test, the SVE system will be started and data will be collected for the purpose of documenting the area of influence. Testing will focus on two vent wells, while the remaining vent wells will be used for monitoring during the area of influence test. The two vent wells will be tested for approximately 6 hours using a step-vacuum test as described in Section 7.3.5 at the frequency summarized in Table 3. At the conclusion of the SVE testing, the system will be shut down and an in situ respiration (ISR) test will be performed using the same vent wells.

Following startup, area of influence testing, and ISR testing a report documenting the results will be submitted to the DTSC. The report will include as-built diagrams, summary of the installation and startup activities, data collected during area of influence testing, data collected during ISR testing, and vacuum versus flow relations for the tested well. In addition, the report will document the plan for O&M and monitoring of the SVE and bioventing systems including a procedure for rebound testing, steps for closure, and copies of air permits.

7.4.5.1 Soil Vapor Sampling

Soil vapor samples will be collected from the vent wells at the frequency shown in Table 3. These samples will be collected in Tedlar bags using a vacuum sample box and analyzed in the field for VOCs using a PID. Samples will also be analyzed for oxygen content, carbon dioxide and explosive gases with a landfill gas monitor (or equivalent meter). Prior to collecting soil vapor samples from the vent wells, a volume equal to approximately two times the casing volume will be purged. The soil vapor samples collected during testing will be analyzed for total hydrocarbons using EPA Method TO-3 and VOCs using EPA Modified Method TO-15.

The vapor extraction will be continued until oxygen concentrations measured in the vent wells is between 19 percent and 21 percent. The system will then be shut down and ISR data will be collected from the test well and the monitoring wells. ISR test vapor samples will be collected from the vent wells at the frequency shown in Table 3, and theses samples will be analyzed, as before, for VOCs, oxygen, carbon dioxide, and methane. Differential pressure, static pressure, and temperature measurements will be recorded at each vent well. The vapor sample collection schedule proposed in Table 3 will be modified as necessary with the goal of continuing sampling until the in situ oxygen content drops by at least 7 percent. These results will be used to calculate the oxygen utilization rate.

7.4.5.2 Vacuum and Flow Rate Monitoring

During startup testing, vacuum at selected vent wells, and the treatment system will be monitored with a hand-held digital manometer at the time intervals shown in Table 3. Vent wells will be sealed at the wellheads during testing by closing the isolation gate valve shown on Figure 10. A quick-disconnect port installed in the piping will be used to measure the wellhead response to the applied vacuum at each SVE well. The observed vacuums will be used in establishing the area of influence.

The flow rate from each vent well will be recorded using a digital hot wire anemometer connected to the SVE system at the time intervals shown in Table 3. The flow rate measurements will be used to assess flow rate capacities for the vent wells.

7.4.6 Operations, Maintenance, and Monitoring

The SVE system will operate initially and be monitored bi-weekly until effluent vapor monitoring from vent wells indicate vapor concentrations have reached asymptotic conditions based on vapor samples collected for laboratory analysis and vapor flow measurements conducted at individual wells and/or the influent to the treatment system. After asymptotic conditions are reached, the system will be converted to bioventing without pulse-mode operation or performance of rebound testing. Pulse mode operations or rebound testing will not be performed because continued remediation of the Stoddard solvent impacts will be achieved through the bioventing process. Bioventing will degrade the less volatile hydrocarbon fraction still present along with any residual volatile constituents that may still be present and are degrading. Following conversion of the SVE and bioventing equipment, start-up will consist of a diagnostic check of the treatment equipment and adjusting the air flow at each vent well. Once operational, the bioventing system will require very little maintenance and monitoring.

The ISR testing performed during startup testing would be periodically repeated to monitor oxygen utilization rates and carbon dioxide production rates to evaluate progress of remediation. Methane, carbon dioxide, oxygen, differential pressure, static pressure, and temperature will be measured using a landfill gas monitor (or equivalent) with a sampling frequency as determined during the startup testing. The measurements will be recorded in a daily field log. The frequency of the ISR testing will be at a minimum monthly for the first six months of operation and quarterly thereafter. Monitoring frequency will be adjusted based on monitoring results. ISR rates can be expected to vary over time and a general decrease in rates over the longer term of hydrocarbon biodegradation. Remediation monitoring reports will be provided to DTSC on a quarterly basis during the first year of operation, then semi-annually thereafter until remediation is deemed complete.

The system will be operated until soil gas monitoring results through existing vent wells indicate biodegradation is no longer occurring at a significant rate. Soil confirmation sampling will then be performed to substantiate that site-specific remediation goals have been achieved for the Stoddard solvent related COCs, and, if necessary to support a deed covenant for the Site.

When the use of the Phase IIIB and IV areas are no longer needed for site construction laydown and staging, or when monitoring data suggest the remediation of the Stoddard solvent vapor phase is sufficient for slab removal, the surface slab and below grade structures will also be demolished and removed in a manner similar to other parts of the Site.

7.4.7 Schedule of Implementation and Completion

SVE and bioventing of shallow and deep Stoddard solvent-impacted soil will begin within 30 days after Site mobilization for below-grade demolition. SVE and bioventing operations will continue until data from soil gas monitoring through existing vent wells indicate that biodegradation is no longer occurring at a significant rate and that soil testing confirms that the site-specific remediation goals have been met.

7.5 SOIL MANAGEMENT DURING AND AFTER BELOW-GRADE DEMOLITION

The demolition contractor will be responsible for handling and disposal of impacted soil removed during demolition. A field Geologist or Engineer will be present while below-grade demolition and soil removal is being performed at the Site. There is a potential for impacted soil to be encountered during removal of pavements, floor slabs, footings, foundations, utilities, and other below-grade structures (e.g., sumps, drains, etc.). As these features are removed during demolition, the demolition contractor will follow the procedures described in this section. The procedures associated with the below grade-demolition described in this section are included in the project technical specifications provided in Appendix B.

During removal of the slab and other below-grade structures, the demolition contractor will monitor for hazardous vapors and observe the condition of the underlying surface of the concrete slab and the condition of the soil underlying the slab. If areas of impacted soil that were not included in the areas shown on Figure 5 and addressed in Section 7.2 are observed (based on visual staining and/or noticeable odors or by testing proposed in Section 7.1.3), the demolition contractor will take the following general steps.

1. Notification - notify both the Site manager and the field Geologist or Engineer present on site, and begin air monitoring with a PID.

2. Monitoring - conduct initial air monitoring for health and safety and SCAQMD permitting compliance with the PID. If PID readings are above Rule 1166 permit criteria, continue using Rule 1166 requirements and the requirements of Section 02114 of the Technical Specifications (Appendix B). If the PID readings are above health and safety air monitoring thresholds, workers will upgrade to the appropriate PPE specified in the demolition contractor's Health and Safety Plan (HASP).

3. Segregation - segregate impacted soil from the slab or structure(s) already being removed. As visually impacted structures are removed, the suspect soil directly adjacent to and beneath the structures will also be excavated, segregated, and/or stockpiled on plastic (with a minimum thickness of 6 mil) and covered with plastic or placed in covered roll-off bins or in end dumps, as needed based on volume.

4. Soil removal - conduct exploratory soil removal to assess the extent of impacted soil based on visual indicators and continue air monitoring:

   - if the area of impacted soil appears to be a "small area" (up to 100 cubic yards of soil), continue to remove soil and stockpile as needed, then continue with demolition work.

   - if the area of impacted soil appears to be greater than 100 cubic yards ("large area"), work in this area will be coordinated and phased with other excavations of known COC-impacted soils. The area will then be visually demarcated by the contractor.

   - COC-impacted areas will then be excavated to the extent necessary to meet site-specific remediation goals discussed in Section 5.3.

5. Confirmation sampling - confirmation soil sampling will be conducted using the procedures described in the QAPP (Geomatrix, 2007). The analytical suite for soil samples tested may include VOCs, PCBs, or metals. If additional samples are collected, the soil analytical results will be compared to the site-specific remediation goals discussed in Section 5.3 to assess the need for additional removal or backfilling of the excavation. If soil testing is deemed not necessary based on existing data, the excavation will be backfilled.

6. Excavation backfill - after confirmation sampling is complete, excavations will be backfilled and compacted by the demolition contractor as described in the Below Grade Demolition Plan (Geomatrix, 2006a). Concrete debris with concentrations of

COCs less than the remediation goals will be crushed to the gradations provided in Section 02050 of the Technical Specifications, and backfilled and compacted pursuant to Section 02351 of the Technical Specifications (Appendix B).

During below-grade demolition, and as required by DTSC, shallow soil testing will be conducted below the buried rail lines during removal. Once the rail lines are removed, shallow soil samples will be collected and tested for metals. In addition, the underlying soil will be observed for petroleum hydrocarbon impacts. If soil samples collected beneath the rail lines are impacted with metals and/or petroleum hydrocarbons at concentrations above the site-specific remediation goals, the steps described above for soil removal, confirmation sampling, and excavation backfill will be conducted.

During these activities, health and safety procedures will be implemented by the demolition contractor as described in the contractor's site-specific HASP. In addition, dust suppression and vapor and/or odor control will be implemented by the demolition contractor as needed using the requirements of Section 01501 of the Technical Specifications (Appendix B).

Any stockpiled soil will be sampled for laboratory analysis. Soil and waste disposal profiling will be completed by the contractor and soil will be transported using appropriate shipping manifests or bills-of-lading. The demolition contractor will notify the Site manager prior to shipping any impacted soil and waste off site. Storm water management associated with the stockpiled materials will be the responsibility of the demolition contractor pursuant to Section 01502 of the Technical Specifications (Appendix B) and the contractor's SWPPP.

After completion of the below-grade demolition, soil excavation work, and installation of the SVE and SVE/bioventing systems, a site-specific soil management plan will be prepared and incorporated into the land use covenant described in Section 7.6. The soil management plan will describe the procedures for handing impacted soil or crushed concrete (containing PCBs greater than or equal to 1 mg/kg) that will remain on Site at concentrations below the site-specific remediation goals.

7.6 LAND USE COVENANT

The Site is zoned for industrial use, and the City of Vernon zoning regulations prohibit development of new residential properties within the City. The future Site use will remain industrial or commercial. A land use deed covenant is proposed to be issued by Pechiney, with concurrence from the City of Vernon, to restrict future site use (i.e., prohibit residential development) and use of groundwater from the first water bearing unit within the site perimeter. The land use covenant will be prepared after completion of the below demolition, soil excavation work and installation of the SVE and SVE/bioventing systems.

7.7 O&M AGREEMENT AND PLAN

The proposed remedy described above in Sections 7.3 and 7.4 (SVE and SVE/bioventing) will be covered under an O&M agreement between Pechiney and DTSC. This agreement will provide a list of the responsibilities for O&M work and it will include items such as future Site access requirements, implementation and monitoring of the SVE and SVE/bioventing systems, and protection and maintenance of the groundwater wells and SVE wells. As part of the agreement, an O&M plan will be prepared and it will be incorporated into the land use covenant for the Site.

8.0 PUBLIC PARTICIPATION

As required by the NCP 40 CFR 300.430(c)(1) and DTSC, Pechiney will ensure that the public is informed and has the opportunity to participate in the overall remedial action for the Site. A comprehensive community involvement plan will be submitted following the submittal of this RAP. Public participation will be implemented as part of demolition and remediation activities. The community involvement program and activities are described below.

8.1 COMMUNITY INVOLVEMENT PROGRAM

The objective of the community involvement program is to inform the community of the progress of demolition and remediation activities and to effectively respond to health, environment and safety concerns and questions. The community involvement program will be consistent with DTSC requirement and CERCLA as implemented by the NCP 40 CFR 300.430(c)(1). The purpose of these activities as stated by the NCP 40 CFR 300.430(c)(2)(ii)(A) is to "ensure the public appropriate opportunities for involvement in a wide variety of site related decisions, including site analysis and characterization, alternatives analysis, and selection of remedy; and to determine, based on community interviews, appropriate activities to ensure such public involvement."

Objectives of the community involvement program include:

- soliciting input from the community on concerns about the remedial activities;
- establishing effective channels of communication between the community, Pechiney, and the DTSC;
- informing the community about progress of the remedial activities; and
- providing adequate opportunities for the community to participate and comment on the proposed remedial activities.

8.2 Community Involvement Activities

To date, Pechiney has conducted community outreach activities to its immediate neighbors including face-to-face visits from the project and field engineers. As part of the below-grade demolition phase of the project, DTSC has begun the community interviews and may distribute information to the immediate neighbors of the Site including proposed activities and schedule of work.

Prior to the start of the remedial activities, DTSC will expand its outreach and distribute an information fact sheet to businesses and residents surrounding the Site and to other interested stakeholders. This fact sheet will include information about the Site, remedial activities, and project contacts. Additionally, a local information repository will be established to make documents and other information available for the public and a Site mailing list will be developed.

This RAP will be made available to the public for a comment period of at least 30 days. DTSC will respond to any comments received during the public comment period and will provide a timely opportunity for the public to access documents.

Depending on the level of community response and level of interest, DTSC may hold a community meeting to discuss the components of the RAP, the Site's history, and proposed remedial work. The meeting may also provide the opportunity for the public to submit comments on the RAP. DTSC will work with the community to develop a meeting format that best suits the needs of the community.

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U.S. Fish and Wildlife Service, email communication from Mr. William B. Miller to Mr. Todd Bernhardt of AMEC Geomatrix on February 1, 2010 regarding a Request for Threatened and Endangered Species List

TABLES

TABLE 1A

SITE-SPECIFIC REMEDIATION GOALS - VOCs IN SOIL VAPOR

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Compound	Remediation Goal (micrograms per liter; μg/L)	Explanation
Phase I Area		
Chloroform	6.7	Derived from the Cancer-based RBSL[1] for Indoor Commercial/Industrial Workers (2.0 μg/L). A chloroform concentration of 6.7 μg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase I area, based on a target cancer risk of 10^{-5}.
Tetrachloroethene (PCE)	7.3	Derived from the Cancer-based RBSL for Indoor Commercial/Industrial Workers (2.2 μg/L). A PCE concentration of 7.3 μg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase I area, based on a target cancer risk of 10^{-5}.
Trichloroethene (TCE)	21	Derived from the Cancer-based RBSL for Indoor Commercial/Industrial Workers (6.3 μg/L). A TCE concentration of 21 μg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase I area, based on a target cancer risk of 10^{-5}.
Phase IIIb and Phase IV Areas		
Total Petroleum Hydrocarbons (TPH) as Stoddard solvent	500	Derived from the Noncancer-based RBSL for Indoor Commercial/Industrial Workers (1500 μg/L). A Stoddard solvent concentration of 500 μg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase IIIb and Phase IV areas, based on a target hazard index of 1.
1,2,4-Trimethylbenzene	12.3	Derived from the Noncancer-based RBSL for Indoor Commercial/Industrial Workers (37 μg/L). A 1,2,4-trimethylbenzene concentration of 12.3 μg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase IIIb and Phase IV areas, based on a target hazard index of 1.
1,3,5-Trimethylbenzene	10.7	Derived from the Noncancer-based RBSL for Indoor Commercial/Industrial Workers (32 μg/L). A 1,3,5-trimethylbenzene concentration of 10.7 μg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase IIIb and Phase IV areas, based on a target hazard index of 1.

Note:
1. RBSL = Risk-Based Screening Level. Developed based on the methodology described in Appendix C of the FS (AMEC, 2011a), RBSLs were used to conduct the screening-level human health risk assessment for the Site.

TABLE 1B

SITE-SPECIFIC REMEDIATION GOALS - PCBs IN SOIL AND CONCRETE, AND METALS AND TPH IN SOIL

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Compound	Remediation Goal (milligrams per kilogram; mg/kg)	Explanation
PCBs[1] in Soil		
Aroclor-1254	2.0	Noncarcinogenic RBSL[2] for construction workers. Also protective of commercial/industrial worker exposure.
Total Aroclors *For soil that may be left exposed at the surface (0 to 5 feet bgs)*	3.5	Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete presented in Appendix E of the FS (AMEC, 2011a), the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 81 picograms/gram (pg/g).[3] Protective of cumulative commercial/industrial worker exposure, and cumulative construction worker exposure, to PCBs.
Total Aroclors *For subsurface soil (5 to 15 feet bgs) that only construction workers may come into contact with during excavation, grading, etc. (and that would remain at 5 to 15 feet bgs)*	23	Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete presented in Appendix E of the FS (AMEC, 2011a), the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 530 pg/g.[4] Protective of cumulative construction worker exposure to PCBs.
PCBs in Concrete		
Total Aroclors	3.5	Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete presented in Appendix E of the FS (AMEC, 2011a), the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 81 pg/g. Also protective of cumulative construction worker exposure to PCBs. Applying this remediation goal ensures that waste criteria for concrete containing PCBs is also met [i.e., less than 50 mg/kg, as defined in 40 CFR Section 761.61(a)(4)(i)(A)].
Metals in Soil		
Arsenic	10	Site-Specific Background Concentration in Soil, established as described in Appendix B of the FS (AMEC, 2011a).
TPH[5] in Soil		
c5-c10 hydrocarbons, c6-c10 hydrocarbons, c7-c12 hydrocarbons, and Stoddard solvent	500	Screening Level for the Protection of Groundwater for TPH gasoline range (c4-c12) from the Los Angeles RWQCB Guidebook.[6]
c10-c20 hydrocarbons and c10-c28 hydrocarbons	1000	Screening Level for the Protection of Groundwater for TPH diesel range (c13-c22) from the Los Angeles RWQCB Guidebook.[6]
c21-c28 hydrocarbons	10,000	Screening Level for the Protection of Groundwater for TPH as residual fuel (c23-c32) from the Los Angeles RWQCB Guidebook.[6]

Notes:

1. PCBs = Polychlorinated Biphenyls
2. RBSL = Risk-Based Screening Level. Developed based on the methodology described in Appendix C of the FS (AMEC, 2011a), RBSLs were used to conduct the screening-level human health risk assessment for the Site.
3. Based on the carcinogenic RBSL for dioxin-like PCB congeners for outdoor commercial/industrial workers (8.1 pg/g TEQ), adjusted to a target cancer risk of 10-5.
4. Based on the carcinogenic RBSL for dioxin-like PCB congeners for construction workers (53 pg/g TEQ), adjusted to a target cancer risk of 10-5.
5. TPH = Total Petroleum Hydrocarbons
6. Los Angeles RWQCB Interim Site Assessment and Cleanup Guidebook (RWQCB Guidebook, May 1996; updated May 2004), for petroleum hydrocarbons and aromatic hydrocarbons (benzene, toluene, ethylbenzene, and total xylenes [BTEX] compounds) in soil. The selected screening levels were taken from Table 4-1 assuming distance above groundwater is 20 to 150 feet.

TABLE 1C

SITE-SPECIFIC REMEDIATION GOALS[1] -
VOCs IN SOIL
Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Depth (Feet)	Concentration in micrograms per kilogram (µg/kg)						
	Trichloroethene	Tetrachloroethene	Benzene	Toluene	Ethylbenzene	Xylenes	1,2-Dichloroethane
0	152	764	15	9058	15,349	97,239	1.8
10	145	732	15	8670	14,690	93,069	1.7
20	138	694	14	8227	13,940	88,314	1.6
30	130	655	13	7769	13,164	83,398	1.5
40	122	615	12	7292	12,356	78,278	1.4
50	114	572	11	6777	11,484	72,756	1.3
60	80	404	8	4790	8116	51,415	0.9
70	60	301	6	3565	6040	38,267	0.7
80	52	260	5	3081	5220	33,071	0.6
90	36	183	4	2164	3667	23,230	0.5
100	27	138	3	1634	2768	17,538	0.5
110	12	59	1	702	1190	7536	0.5
120	9	44	1	530	900	5694	0.5
130	5	19	1	229	391	2466	0.5
140	5	10	1	150	300	1750	0.5
149	5	5	1	150	300	1750	0.5

Note:
1. Calculations based on Appendix A, "Attenuation Factor Method For VOCs" of "Remediation Guidance For Petroleum and VOC Impacted Sites" in Interim Site Assessment & Cleanup Guidebook published by the California Regional Water Quality Control Board, Los Angeles Region.

TABLE 2

SUMMARY OF ALTERNATIVES AND EVALUATION CRITERIA
Former Pechiney Cast Plate, Inc. Facility
Vernon, California

Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Overall Protection of Human Health and Environment	○	●	●	ϴ
Compliance with State and Federal Requirements (ARARs)	○	●	●	●
Long-term Effectiveness and Permanence	○	●	●	●
Reduction of Toxicity, Mobility or Volume through Treatment	○	●	●	ϴ
Total Cost	$0	$33,200,000	$4,400,000	$14,300,000
Short-term Effectiveness	○	●	●	●
Implementability	●	●	●	ϴ
Regulatory Agency Acceptance	○			
Community Acceptance	○			

● = Fully meets criterion

ϴ = Partially meets criterion

○ = Does not meet criterion

Alternative 1: No Action

Alternative 2: Excavation and Disposal of COC-Impacted Soil and Demolition and Disposal of PCB-Impacted Concrete

Alternative 3: Excavation and Disposal of Shallow COC-Impacted Soil, SVE for Shallow and Deep VOC-Impacted Soil, SVE and Bioventing for Shallow and Deep Stoddard Solvent-Impacted Soil, and Demolition and Disposal of PCB-Impacted Concrete

Alternative 4: In Situ Stabilization of Shallow PCB/Metals-Impacted Soil and Deep Stoddard Solvent-Impacted Soil, SVE for Shallow and Deep VOC-Impacted Soil, and Demolition and Disposal of PCB-Impacted Concrete

TABLE 3

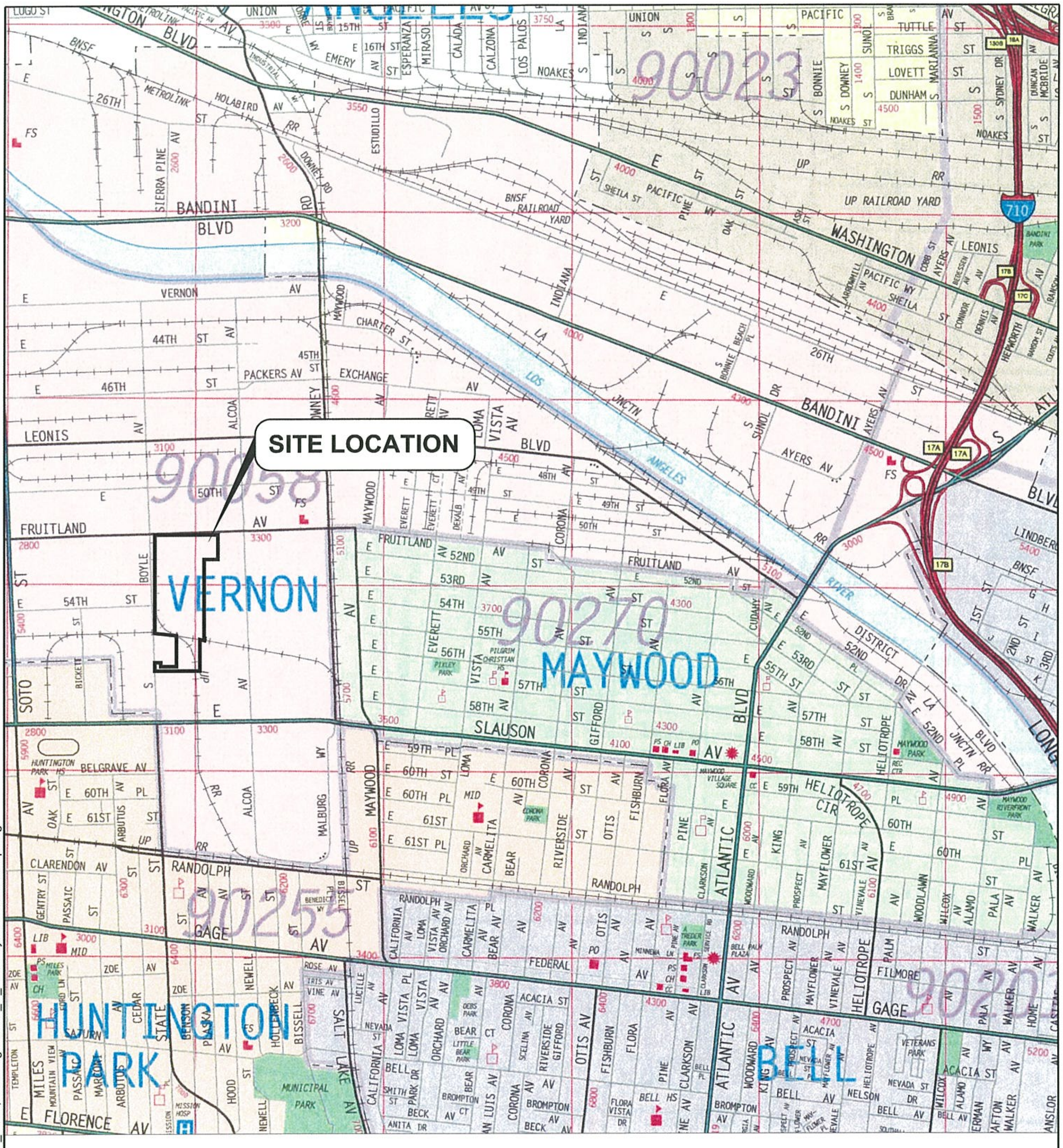
SVE AND RESPIROMETRY STARTUP PLAN

Former Pechiney Cast Plate, Inc. Facility
Vernon, California

SVE STARTUP/AREA OF INFLUENCE TESTING				
	· Vary applied vacuum to each test well:	4, 6, 8 in Hg		
	· Time Increment:	2 hours per applied vacuum (step)		
	· Two vapor extraction wells:	6 hours per well		
	FIELD PARAMETER MONITORING SCHEDULE			
	Parameter	**Monitoring Points[1]**	**Time[2]**	**Method[3]**
	Vapor VOC Concentrations	2 test wells	start and each 2 hours	PID[4]
		all monitoring wells	beginning and end of each step	
		system inlet and outlet	at end of each 2 hours operation	
	Vacuum	test and all monitoring wells	0, 30, 60, 90, 120 minutes	Manometer
	Flow rate	2 test wells	0, 30, 60, 90, 120 minutes	Hot Wire Anemometer
	LABORATORY SAMPLING AND ANALYSIS SCREENING			
	Parameter	**Monitoring Points[1]**	**Time[2]**	**Method[5]**
	VOC Concentrations	2 test wells	At end of each 2 hours operation	TO-3, TO-15
	Total VOCs and speciation	system inlet and outlet	120 minutes	TO-3, TO-15[6]
BIOVENT OPERATION/RESPIRATION TESTING				
	· Shut down system after verifying initial oxygen concentrations meet target of 19% to 21%.			
	· Select up to four respiration test wells based on operation and initial readings.			
	· Collect samples at start and 1/2, 1, 2, 3, 4, 6 hours with variation as necessary based on observed oxygen depletion rates.			
	· Respiration testing shall not occur during periods of falling barometric pressure (windy or inclement weather.)			
	FIELD PARAMETER MONITORING SCHEDULE			
	Parameter	**Monitoring Points[1]**	**Time[2]**	**Method[3]**
	Vapor VOC Concentrations	all wells	end of testing	PID
		test wells	0, 1/2, 1, 2, 3, 4, 6 hours	
	CO_2, O_2, and methane	all wells	end of testing	Landfill Gas Monitor[7]
		test wells	0, 1/2, 1, 2, 3, 4, 6 hours	
	Vacuum	test wells	0, 1/2, 1, 2, 3, 4, 6 hours	Manometer
SVE OPERATION				
	FIELD PARAMETER MONITORING SCHEDULE			
	Parameter	**Monitoring Points[1]**	**Time[2]**	**Method[3]**
	Vapor VOC Concentrations	all wells	Monthly	PID
		system inlet and outlet	Weekly[6]	
	Vacuum	all wells	Monthly	Manometer
	Flow rate	all wells	Monthly	Hot Wire Anemometer
	LABORATORY SAMPLING AND ANALYSIS SCREENING			
	Parameter	**Monitoring Points[1]**	**Time[2]**	**Method[4]**
	Total VOCs and speciation	system inlet and outlet	Monthly	TO-3, TO-15[5]

Notes:
1. Two wells will be selected for startup and area of influence testing.
2. Time after commencement of test run.
3. Field instrument, device, or sample container.
4. PID = photoionization detector; samples will be collected in a Tedlar bag using a vacuum sample collection box and analyzed with a PID.
5. Laboratory method.
6. Subject to permit requirements.
7. Hand-held instrument to determine O_2, CO_2, and LEL may be CES Landtec GEM-500, CES Landtec GEM-2000, or engineer-approved equivalent.

FIGURES



0 1000 2000
Approximate Scale in Feet

SITE LOCATION MAP
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 1

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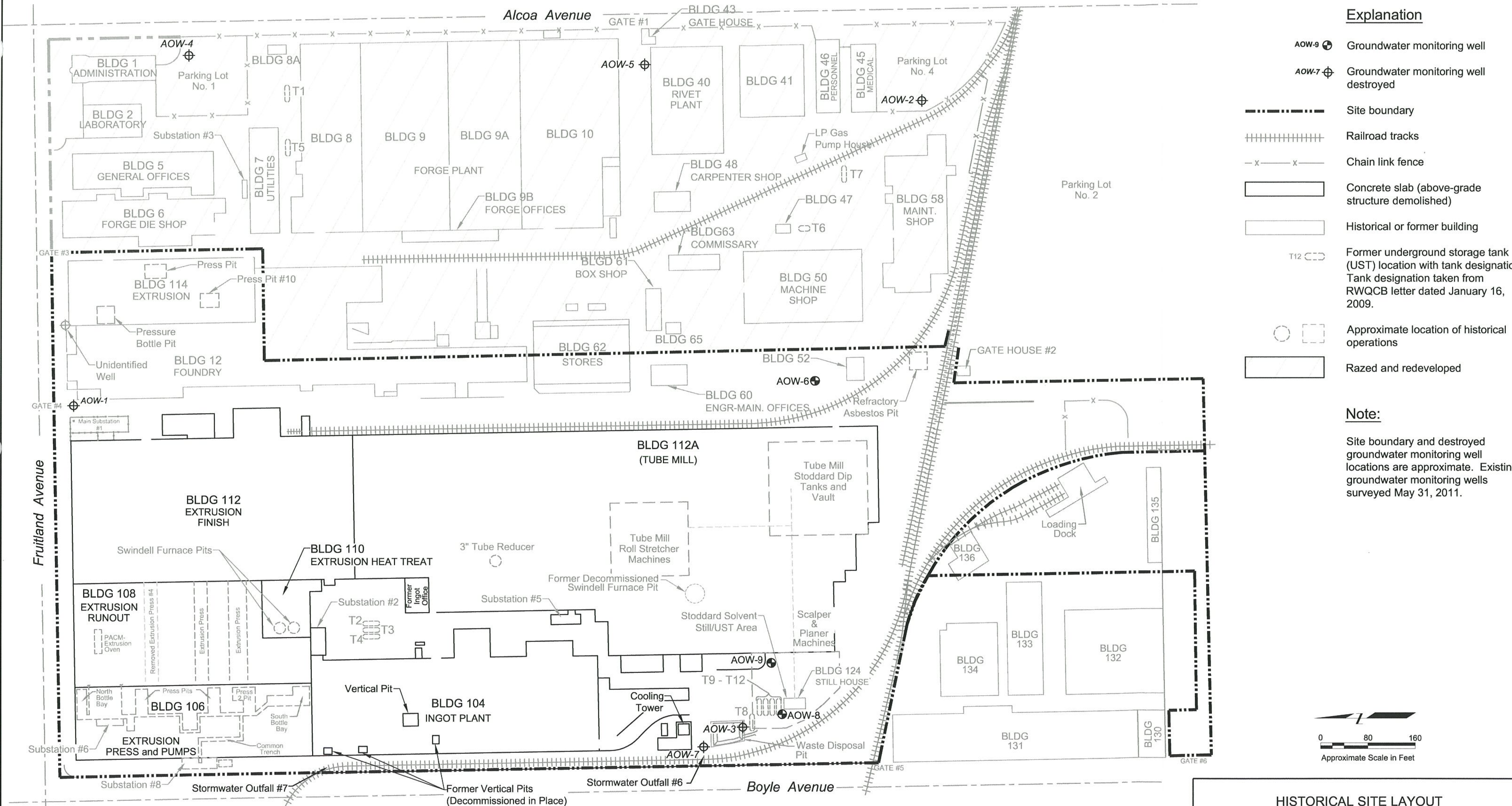

HISTORICAL SITE LAYOUT
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 2

Plot Date: 04/05... 4pm, Plotted by: pat.herring
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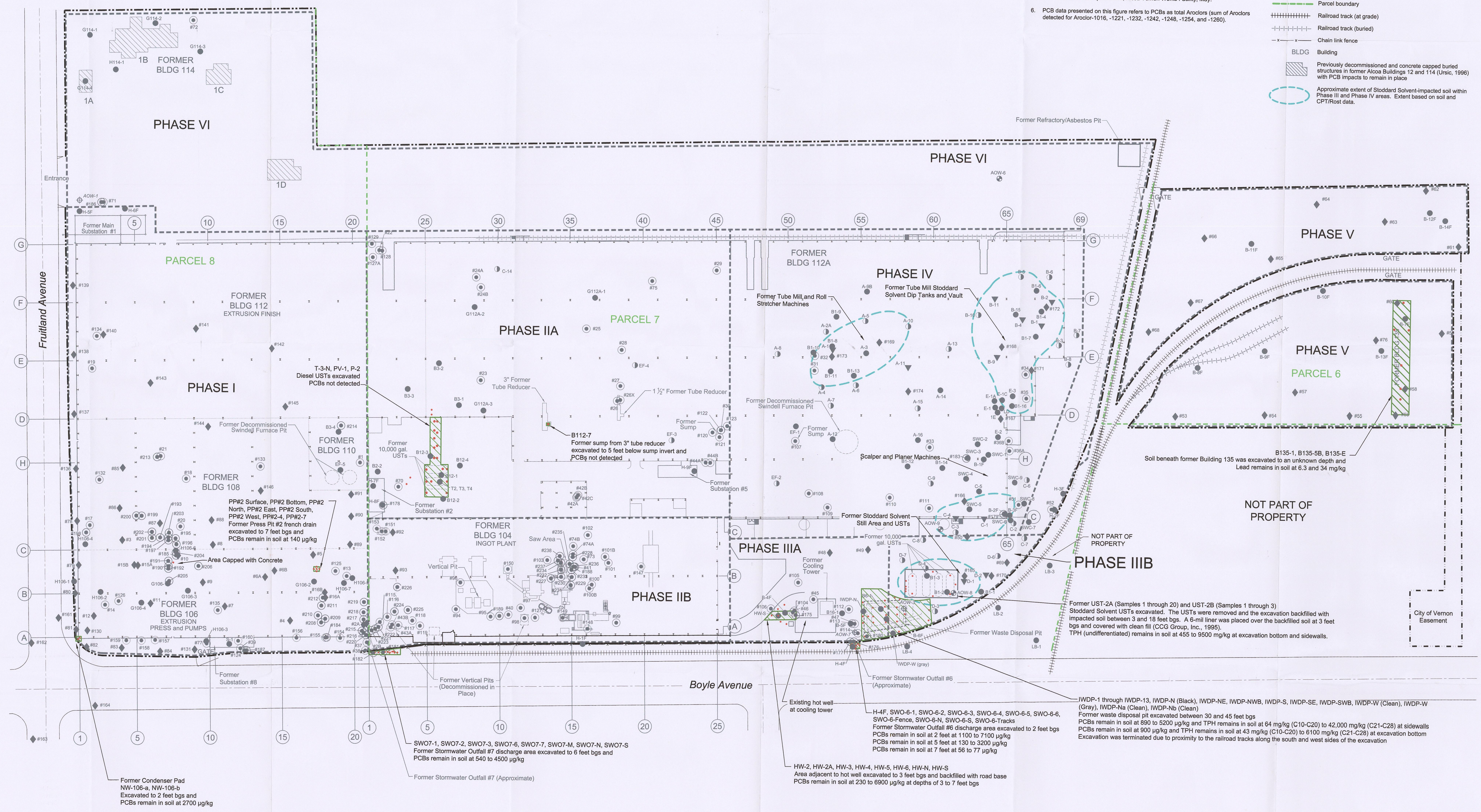


Notes:

1. Historical sample locations are approximate.
2. PCB sample results reported in micrograms per kilogram (µg/kg). See Appendix A of the FS (AMEC Geomatrix, 2011).
3. TPH sample results reported in milligrams per kilogram (mg/kg).
4. Concrete core locations are shown on Figure 4.
5. The approximate extent of Stoddard Solvent-impacted soil is based on the following documents:
   - Environmental Protection and Compliance, Inc., 2006, Stoddard Solvent Impacted Soils Investigation in Support of Monitored Natural Attenuation Survey No. 5, September 26-October 4, 2005, Former Alcoa Vernon Facility, Vernon, California, May 25.
   - Morrison Knudsen Corporation, 1995, Final Report Stoddard Solvent System Field Investigation, Aluminum Company of America, October 27.
   - CCG Group, Inc., 1995, Final Report for Closure, Underground Storage Tank Removal and Replacement, Alcoa Vernon Works Facility, May.
6. PCB data presented on this figure refers to PCBs as total Aroclors (sum of Aroclors detected for Aroclor-1016, -1221, -1232, -1242, -1248, -1254, and -1260).

Explanation

- Previous excavation area (all previous limits of excavation are approximate)
- Sample taken during excavation activities
- AOW-9 Groundwater monitoring well
- #90 Geomatrix and AMEC Geomatrix soil vapor sampling point
- #109 Geomatrix and AMEC Geomatrix soil boring
- B-1 Approximate location of historical boring
- D-1 Approximate location of historical CPT
- C-1 Approximate location of historical vapor extraction well (destroyed 2006)
- 20 B Column and row numbering system for footings
- Site boundary
- Phasing area boundary
- Parcel boundary
- Railroad track (at grade)
- Railroad track (buried)
- Chain link fence
- BLDG Building
- Previously decommissioned and concrete capped buried structures in former Alcoa Buildings 12 and 114 (Ursic, 1996) with PCB impacts to remain in place
- Approximate extent of Stoddard Solvent-impacted soil within Phase III and Phase IV areas. Extent based on soil and CPT/Rost data.

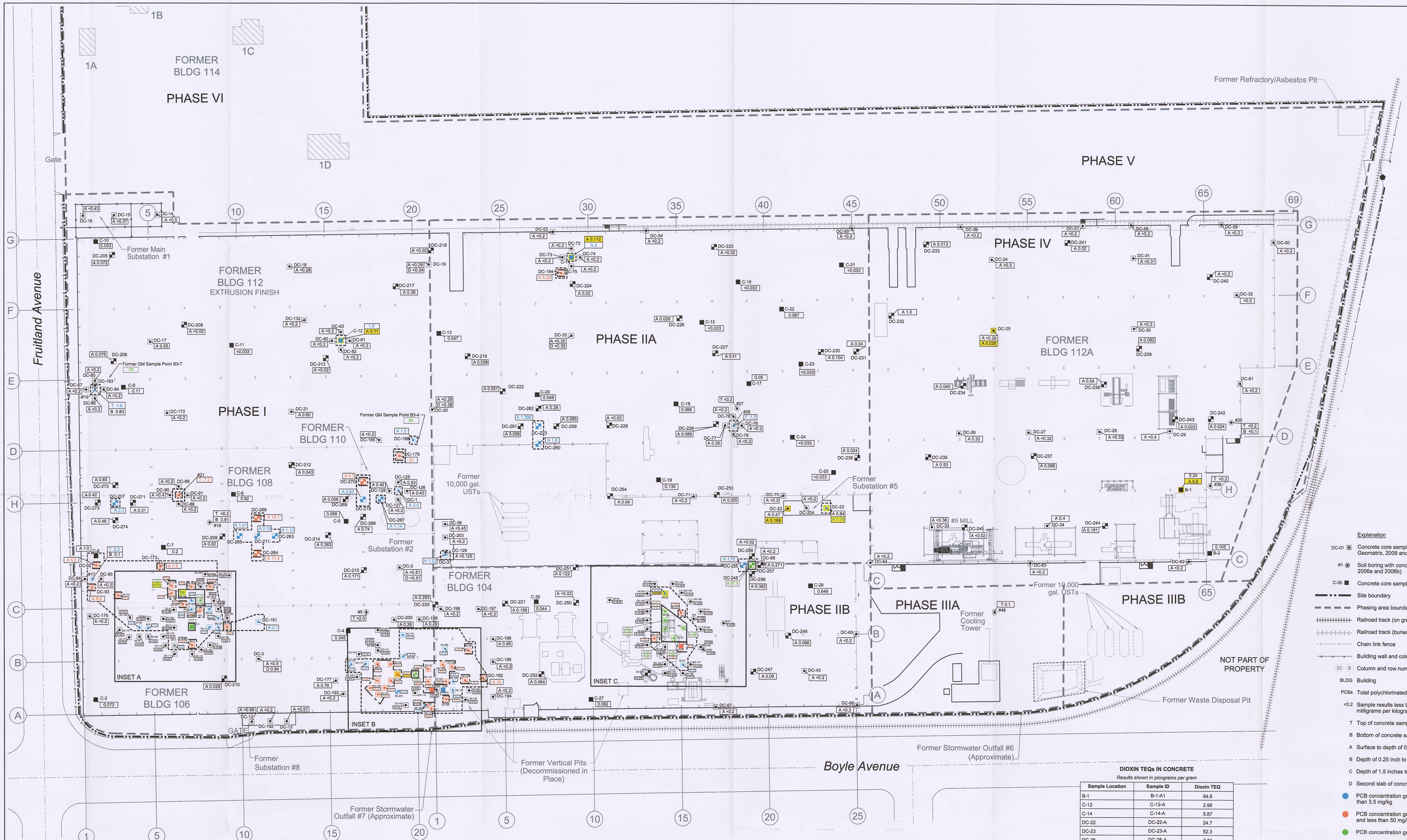
0 25 50
Approximate Scale in Feet

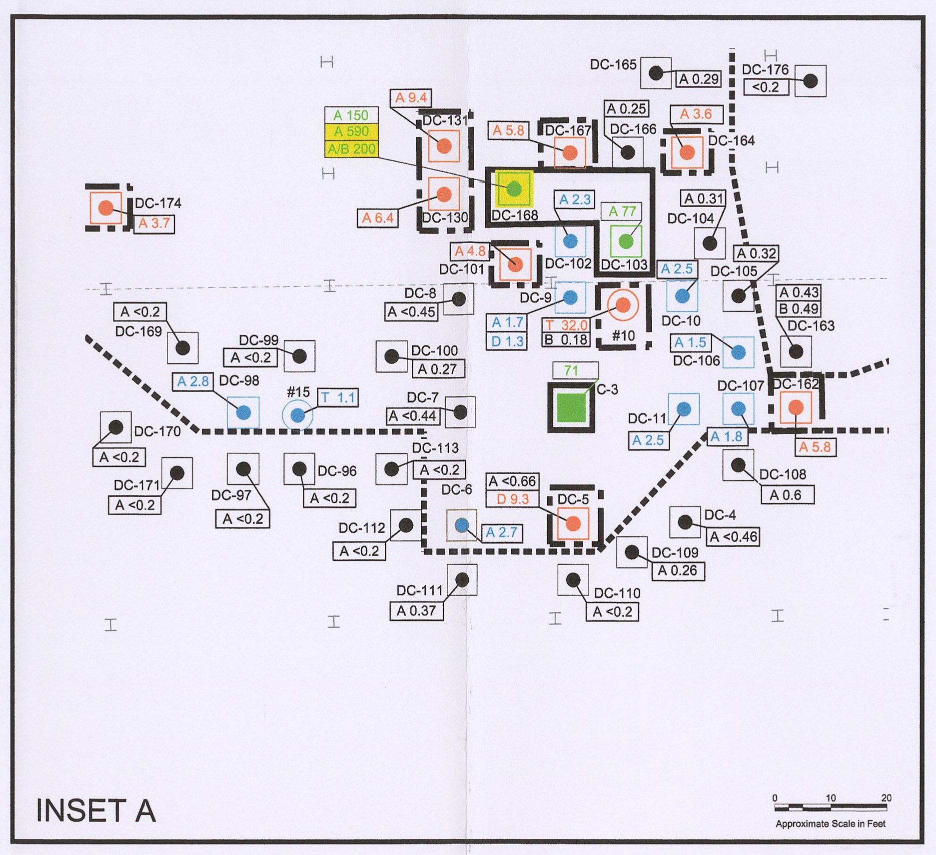
Basemap modified from Pechiney Cast Plate, Inc. Site Plan dated January 9, 2002; Geraghty & Miller, Inc. "Groundwater Elevation and Volatile Organic Compound Concentrations December 8, 1994" Figure dated February 2, 1995; Aluminum Company of America "Works General-MPA" Figure dated October 10, 1984; and Los Angeles County Assessor's Office Parcel Map 6310/Sheet 8 dated November 5, 1958.

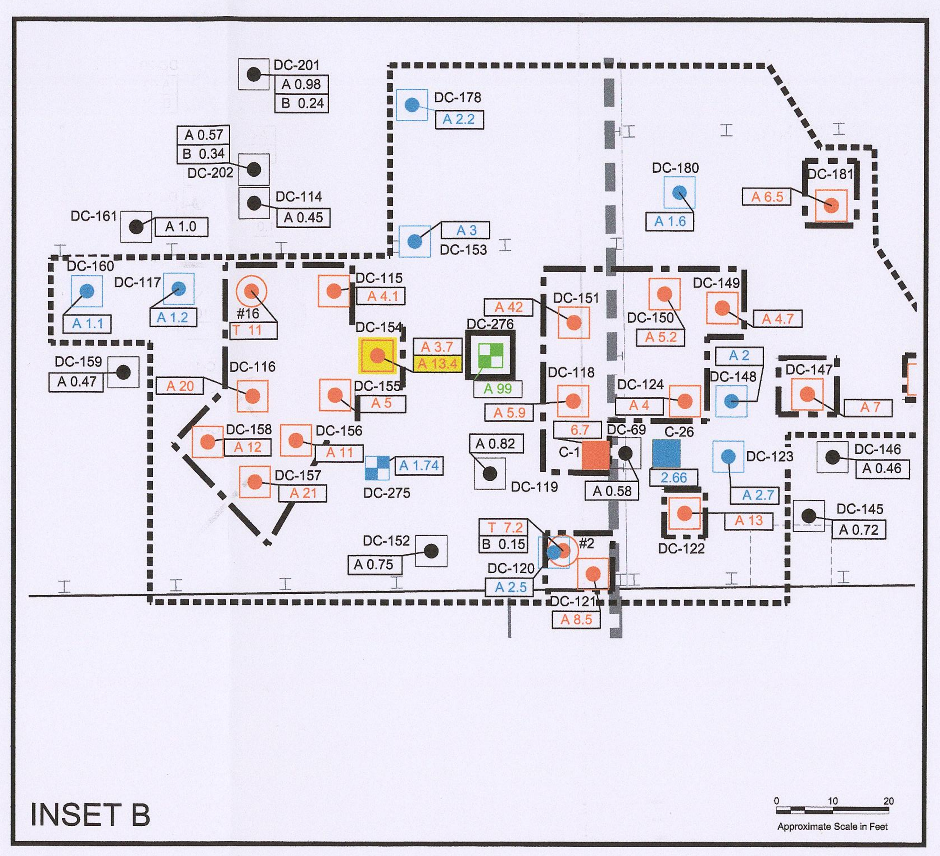
Note: Figure shall be produced in color to maintain information.

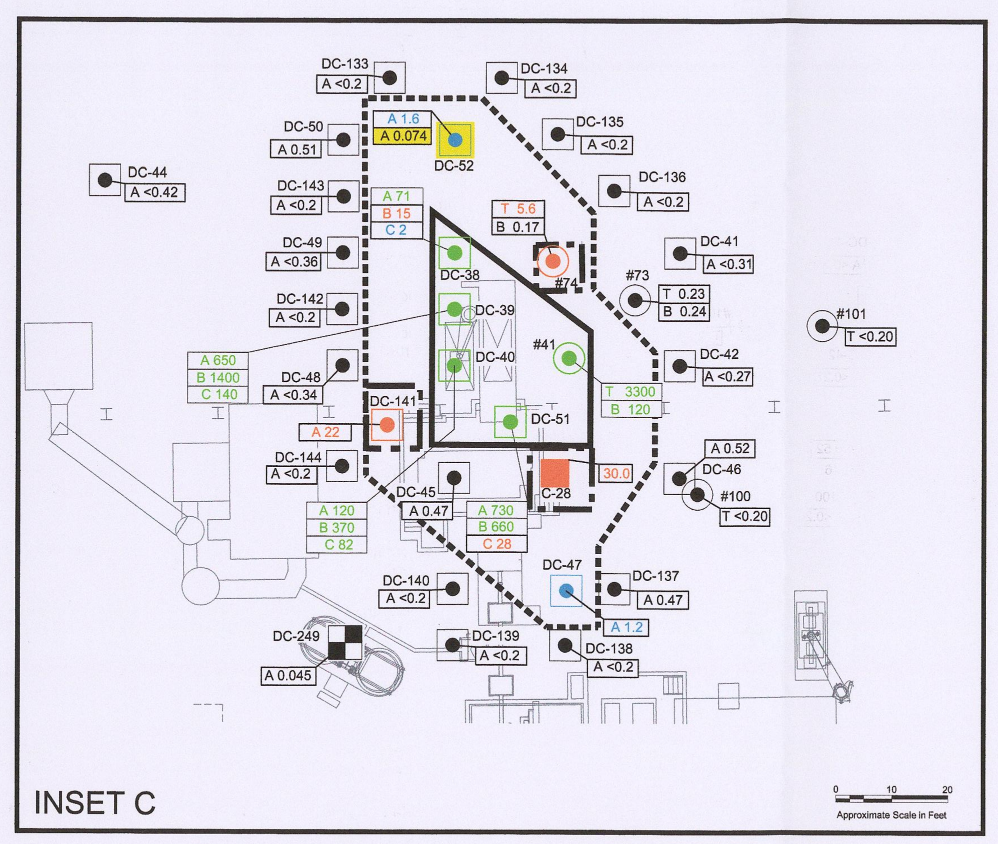
SAMPLE LOCATIONS AND AREAS PREVIOUSLY EXCAVATED
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 3









DIOXIN TEQs IN CONCRETE

Results shown in picograms per gram

Sample Location	Sample ID	Dioxin TEQ
B-1	B-1-A1	94.6
C-12	C-12-A	2.96
C-14	C-14-A	5.87
DC-22	DC-22-A	24.7
DC-23	DC-23-A	52.3
DC-25	DC-25-A	2.81
DC-52	DC-52-A	5.13
DC-154	DC-154-A	656
DC-168	DC-168-C	14,250

TEQ = Toxic Equivalent

Notes:

1. All locations are approximate.
2. All samples are bulk samples unless noted otherwise.
3. Samples analyzed using EPA Method 8082; refer to Appendix A of the FS (AMEC Geomatrix, 2011) for a summary of test methods and analytical results.
4. Bulk sample results reported in milligrams per kilogram (mg/kg).
5. References:
   - AMEC Geomatrix, Inc., 2009, Polychlorinated Biphenyls Notification Plan, Former Pechiney Cast Plate, Inc., Facility, Vernon, California, July 10.
   - AMEC Geomatrix, Inc., 2010, Responses to U.S. EPA Conditions C.2, C.3, C.5, and C.6 listed in the July 2, 2010 Conditional Approval, Former Pechiney Cast Plate Facility, Vernon, California, December 29.
   - Geomatrix Consultants, Inc. (Geomatrix), 2006a, Phase II Environmental Site Assessment Report, Pechiney Cast Plate Facility, Vernon, California, March 9.
   - Geomatrix, 2006b, Supplemental Phase II Environmental Site Assessment Report, Pechiney Cast Plate Facility, Vernon, California, December 19.
   - Geomatrix, 2006c, Above Grade Demolition Completion Report, Pechiney Cast Plate, Inc. Facility, Vernon, California, December 26.
   - McCulley, Frick & Gilman (MFG), 1998, Limited Phase II Environmental Investigation, Alcoa Cast Plate, 5151/5401 Alcoa Avenue, Vernon, California, September 15.
   - Geraghty and Miller, Inc., 1990, Final Report, Phase III Environmental Assessment for Alcoa - Vernon Plant, Vernon, California, September 6.
6. PCB data presented on this figure refers to PCBs as total Aroclors (sum of Aroclors detected for Aroclor-1016, -1221, -1232, -1242, -1248, -1254, and -1260).

Explanation

DC-01 Concrete core sample (Geomatrix, 2006c and AMEC Geomatrix, 2009 and 2010)

#1 Soil boring with concrete core sample (Geomatrix, 2006a and 2006b)

C-30 Concrete core sample (MFG, 1998)

Site boundary

Phasing area boundary

Railroad track (on grade)

Railroad track (buried)

Chain link fence

Building wall and columns

20 B Column and row numbering system for footings

BLDG Building

PCBs Total polychlorinated biphenyls

<0.2 Sample results less than the reporting limit shown in milligrams per kilogram (mg/kg)

T Top of concrete sample

B Bottom of concrete sample

A Surface to depth of 0.25 inch

B Depth of 0.25 inch to 1.5 inches

C Depth of 1.5 inches to 3.0 inches

D Second slab of concrete

PCB concentration greater than 1 mg/kg and less than 3.5 mg/kg

PCB concentration greater than or equal to 3.5 mg/kg and less than 50 mg/kg

PCB concentration greater than or equal to 50 mg/kg

PCB-impacted concrete greater than 1 mg/kg

PCB-impacted concrete greater than or equal to 3.5 mg/kg

PCB-impacted concrete greater than or equal to 50 mg/kg

Additional concrete locations sampled and analyzed for PCB Aroclors using EPA Method 8082 (September and October 2010)

Concrete locations sampled and analyzed for PCB Aroclors using EPA Method 8082 and PCB Congeners using EPA Method 1668B; concrete sample collected adjacent to previous location (September 2010)

Note: Figure shall be produced in color to maintain information.

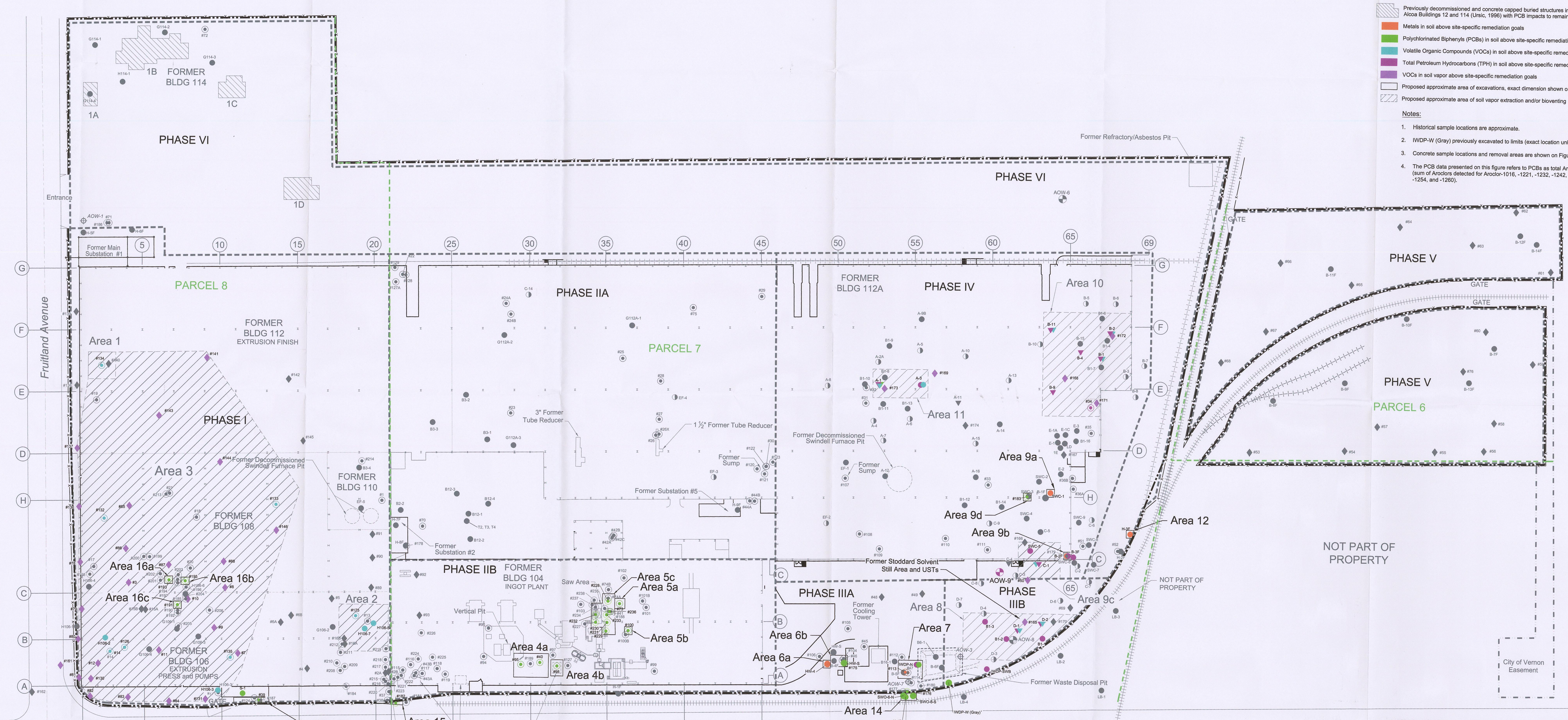
Approximate Scale in Feet

0 20 40

Basemap modified from Pechiney Cast Plate, Inc. Site Plan dated January 9, 2002; Geraghty & Miller, Inc. "Groundwater Elevation and Volatile Organic Compound Concentrations December 8, 1994" Figure dated February 2, 1995; Aluminum Company of America "Works General-MPA" Figure dated October 10, 1984; and Los Angeles County Assessor's Office Parcel Map 6310/Sheet 8 dated November 5, 1958.

CONCRETE CHARACTERIZATION SAMPLE LOCATIONS AND PCB CONCENTRATIONS
Former Pechiney Cast Plate Facility
3200 Fruitland Avenue
Vernon, California

By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 4



Former Stormwater Outfall #7 (Approximate)

Former Stormwater Outfall #6 (Approximate)

Explanation

- AOW-9 Groundwater monitoring well
- AOW-3 Groundwater monitoring well destroyed
- #90 Geomatrix and AMEC Geomatrix soil vapor sampling point
- #109 Geomatrix and AMEC Geomatrix soil boring
- B-1 Approximate location of historical boring
- D-1 Approximate location of historical CPT
- C-1 Approximate location of historical vapor extraction well (destroyed 2006)
- 20 B Column and row numbering system for footings
- Site boundary
- Phasing area boundary
- Parcel boundary
- Railroad track (at grade)
- Railroad track (buried)
- Chain link fence
- BLDG Building
- Previously decommissioned and concrete capped buried structures in former Alcoa Buildings 12 and 114 (Ursic, 1996) with PCB impacts to remain in place
- Metals in soil above site-specific remediation goals
- Polychlorinated Biphenyls (PCBs) in soil above site-specific remediation goals
- Volatile Organic Compounds (VOCs) in soil above site-specific remediation goals
- Total Petroleum Hydrocarbons (TPH) in soil above site-specific remediation goals
- VOCs in soil vapor above site-specific remediation goals
- Proposed approximate area of excavations, exact dimension shown on table
- Proposed approximate area of soil vapor extraction and/or bioventing

Notes:

1. Historical sample locations are approximate.
2. IWDP-W (Gray) previously excavated to limits (exact location unknown).
3. Concrete sample locations and removal areas are shown on Figure 4.
4. The PCB data presented on this figure refers to PCBs as total Aroclors (sum of Aroclors detected for Aroclor-1016, -1221, -1232, -1242, -1248, -1254, and -1260).

Area Designation	Length (ft)	Width (ft)	Depth (ft)	COC(s)	Notes
1	--	--	--	VOCs	Soil Vapor Extraction
2	--	--	--	VOCs	Soil Vapor Extraction
3	--	--	--	VOCs	Soil Vapor Extraction
4a	45	30	15	PCBs	Excavation
4b	15	18	11	PCBs	Excavation (removal of material within former vertical pit)
5a	10	10	4	PCBs	Excavation
5b	10	10	4	PCBs	Excavation
5c	15	25	4	PCBs	Excavation
	15	55	4		
6a	15	15	8	Arsenic	Excavation
6b	25	15	4	PCBs	Excavation
7	30	25	12	PCBs, Arsenic	Excavation
8	--	--	--	Stoddard Solvent, VOCs	Soil Vapor Extraction/Bioventing
9a	5	5	2	Arsenic	Excavation
9b	5	5	2	Arsenic	Excavation
9c	--	--	--	Stoddard Solvent, VOCs	Soil Vapor Extraction/Bioventing
9d	5	5	2	PCBs	Excavation
10	--	--	--	Stoddard Solvent, VOCs	Soil Vapor Extraction/Bioventing
11	--	--	--	Stoddard Solvent, VOCs	Soil Vapor Extraction/Bioventing
12	5	5	2	Arsenic	Excavation
13	40	2	3	PCBs	Excavations (surface gravel and shallow soil)
14	10	5	5	PCBs	Excavation
15	3	3	8	PCBs	Excavation
16a	5	5	3	PCBs	Excavation
16b	5	5	3	PCBs	Excavation
16c	5	5	3	PCBs	Excavation

Notes:
COCs = Constituents of Concern.
All dimensions are approximate.

Note: Figure shall be produced in color to maintain information.

0 25 50
Approximate Scale in Feet

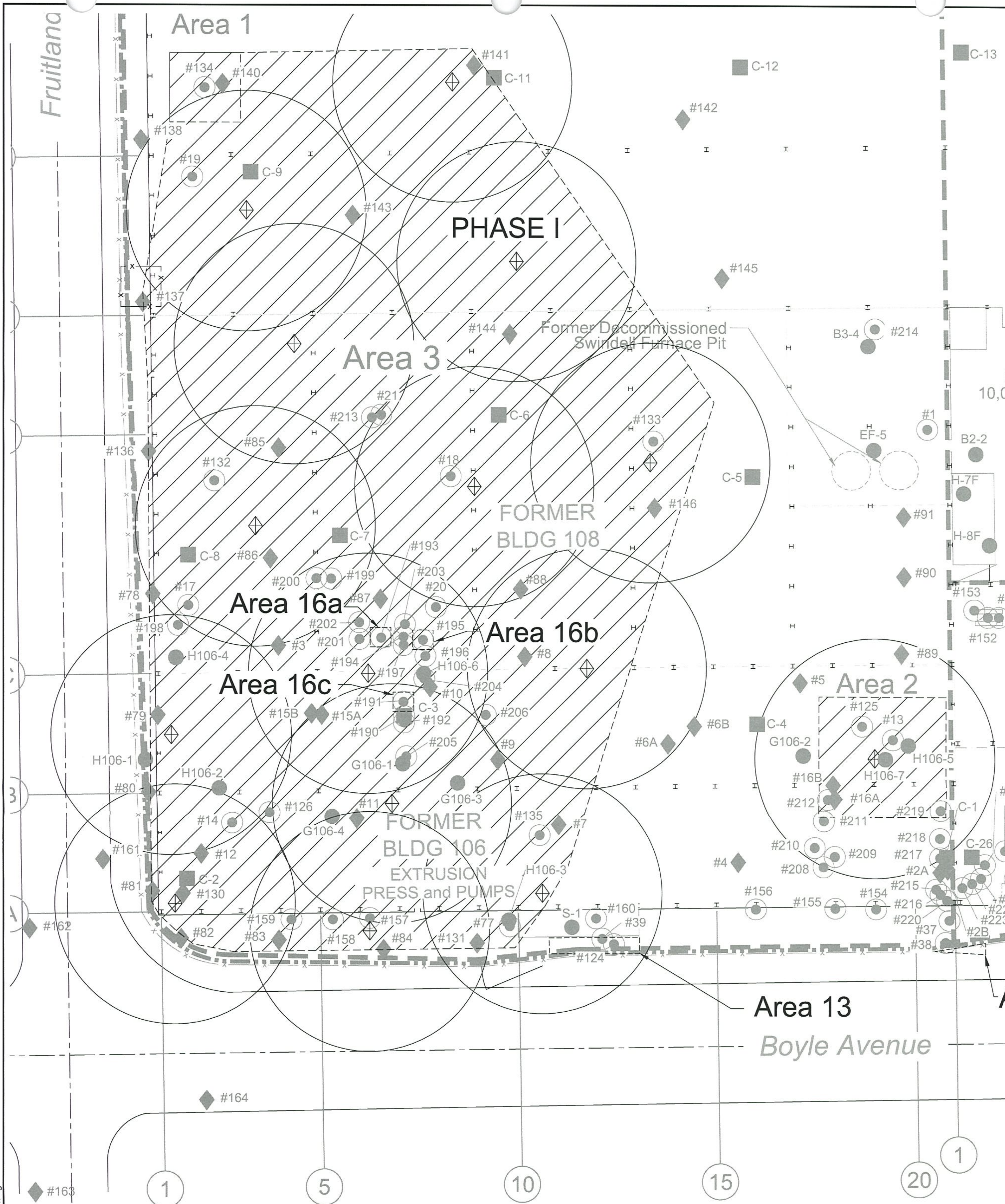
Basemap modified from Pechiney Cast Plate, Inc. Site Plan dated January 9, 2002; Geraghty & Miller, Inc. "Groundwater Elevation and Volatile Organic Compound Concentrations December 8, 1994" Figure dated February 2; 1995, Aluminum Company of America "Works General-MPA" Figure dated October 10, 1984; and Los Angeles County Assessor's Office Parcel Map 6310/Sheet 8 dated November 5, 1958.

PROPOSED SOIL REMEDIATION AREAS
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

By: pah | Date: 07/27/11 | Project No. 10627.003

AMEC Geomatrix

Figure 5



Explanation

- Proposed shallow soil vapor extraction well locations
- #90 Geomatrix soil vapor sampling point
- #109 Geomatrix soil boring
- G106-1 Approximate location of historical boring
- C-30 Approximate location of historical concrete core sample
- Limits of work
- Phasing area boundary
- Chain link fence
- BLDG Building
- Proposed approximate area of soil vapor extraction
- Soil vapor extraction treatment system compound
- Radius of Influence 60 feet

0 25 50

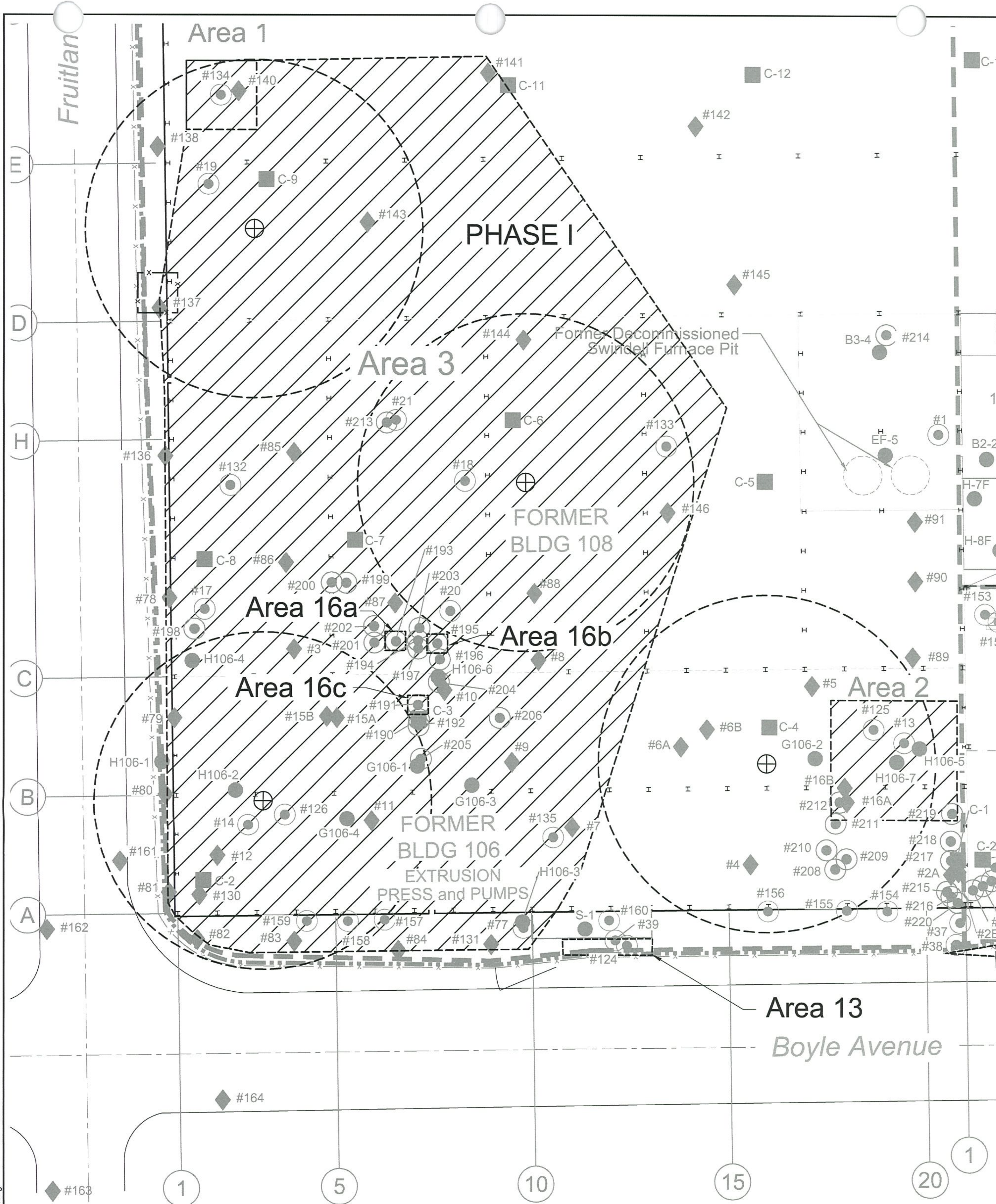
Approximate Scale in Feet

Basemap modified from Pechiney Cast Plate, Inc. Site Plan dated January 8, 2002, Geraghty & Miller, Inc. "Groundwater Elevation and Volatile Organic Compound Concentrations December 8, 1994" Figure dated February 2, 1995, Aluminum Company of America "Works General-Map" Figure dated October 10, 1984, and Los Angeles County Assessor's Office Parcel Map 6310 / Sheet 8 dated November 5, 1958.

PROPOSED SHALLOW SVE WELL LOCATIONS
PHASE I AREA
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 6

Plot Date: 07/27/11 - 11:19am, Plotted by: pat.herring
Drawing Path: Y:\10627.003.0\acad\Reports_2011\RAP_2011\, Drawing Name: _tb_proposed SVE well locations.dwg



Explanation

- ⊕ Proposed deeper soil vapor extraction well locations
- #90 Geomatrix soil vapor sampling point
- #109 Geomatrix soil boring
- G106-1 Approximate location of historical boring
- C-30 Approximate location of historical concrete core sample
- Limits of work
- Phasing area boundary
- Chain link fence
- BLDG Building
- Proposed approximate area of soil vapor extraction
- Soil vapor extraction treatment system compound
- Radius of Influence 85 feet

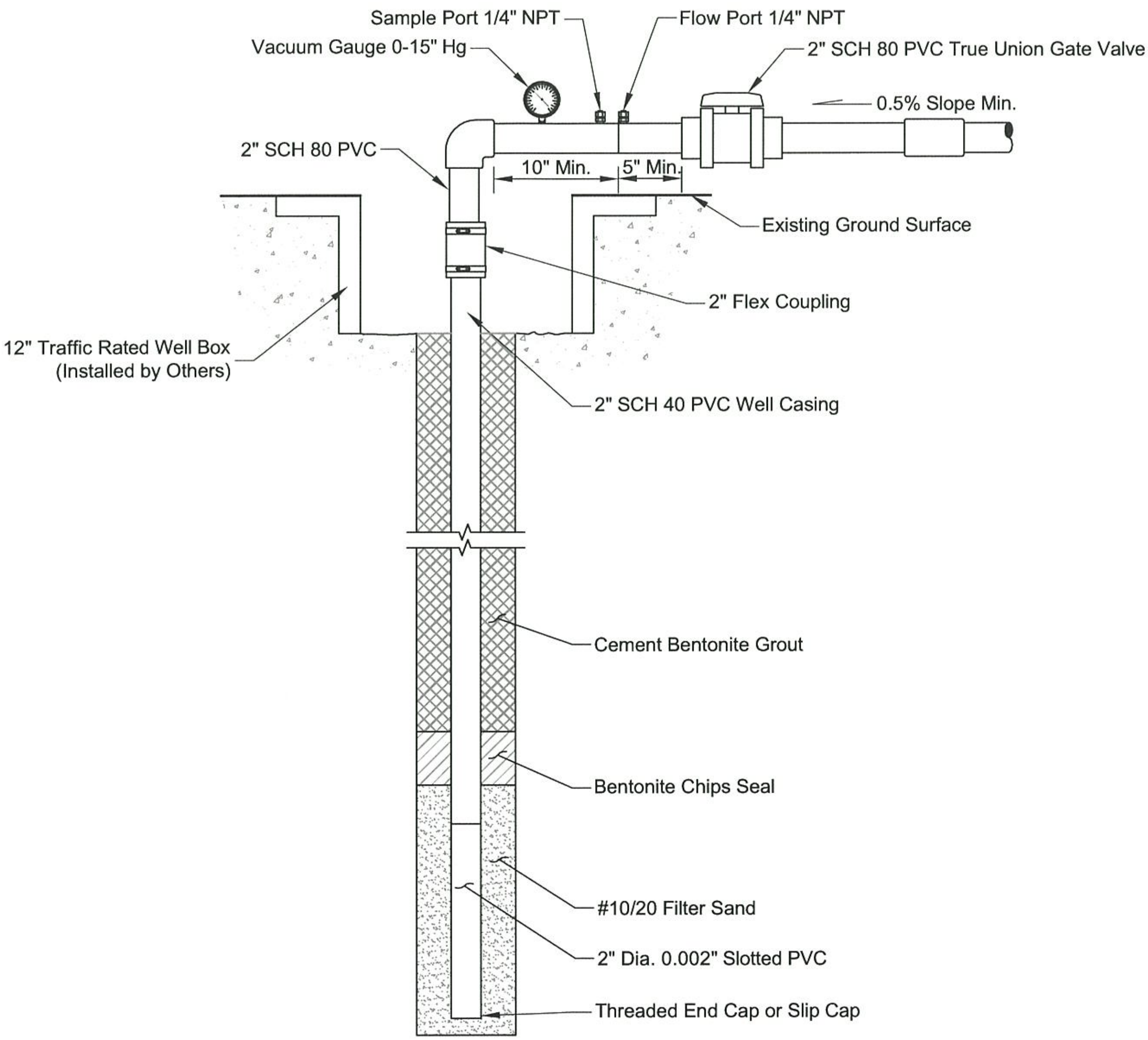
0 25 50
Approximate Scale in Feet

Basemap modified from Pechiney Cast Plate, Inc. Site Plan dated January 8, 2002, Geraghty & Miller, Inc. "Groundwater Elevation and Volatile Organic Compound Concentrations December 8, 1994" Figure dated February 2, 1995, Aluminum Company of America "Works General-Map" Figure dated October 10, 1984, and Los Angeles County Assessor's Office Parcel Map 6310 / Sheet 8 dated November 5, 1958.

PROPOSED DEEP SVE WELL LOCATIONS
PHASE I AREA
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 7

Plot Date: 04/06/12 - 10:16am, Plotted by: pat.herring
Drawing Path: Y:\10627.003.0\acad\Reports_2011\RAP_2011\, Drawing Name: _tb_proposed SVE well locations.dwg

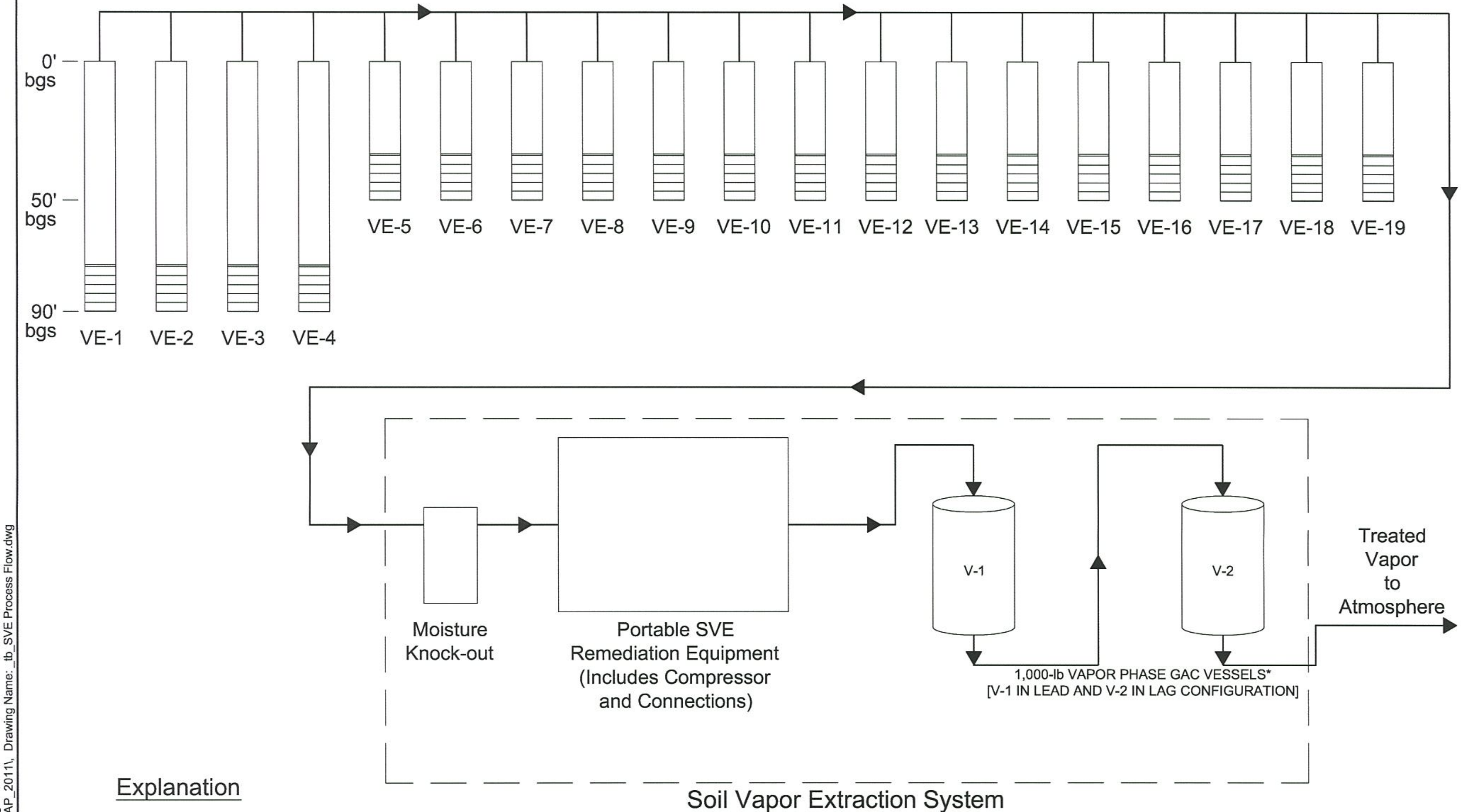


Not to Scale

EXTRACTION WELLHEAD AND WELL CONSTRUCTION DETAIL (SIDE VIEW)
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 8

Plot Date: 04/06/12 - 10:29am, Plotted by: pat.herring
Drawing Path: Y:\10627.003.0\acad\Reports_2011\RAP_2011\, Drawing Name: tb_Extraction_Wellhead_Detail.dwg



Explanation

' = feet

bgs = below ground surface

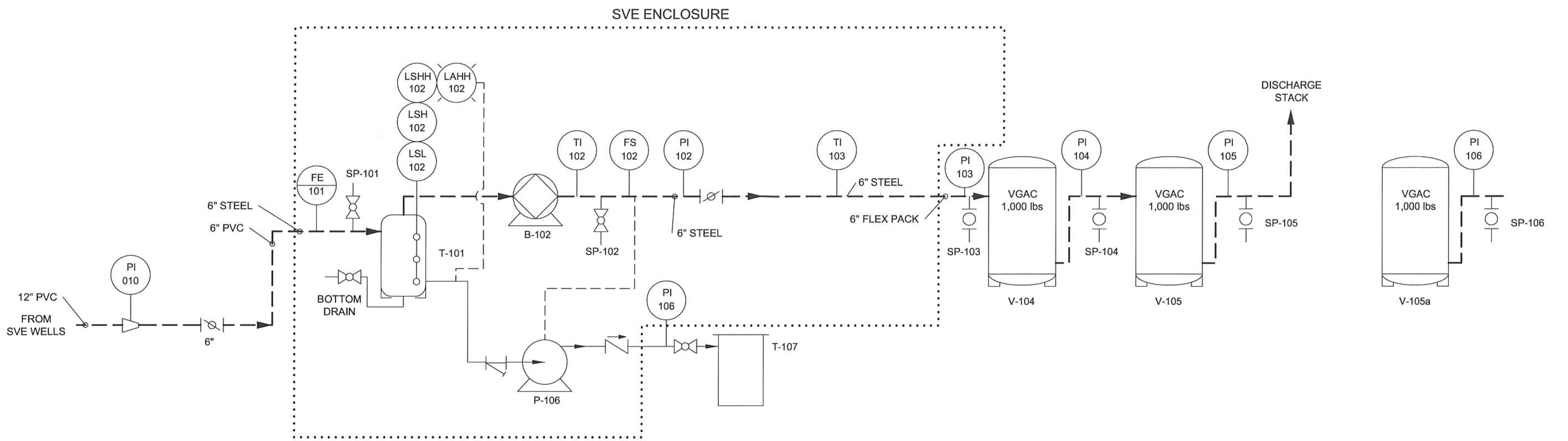
GAC = Granular Activated Carbon

* = or as specified in South Coast Air Quality Management District permit

PHASE I SVE PROCESS FLOW DIAGRAM
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 9

Plot Date: 04/06/12 - 10:29am, Plotted by: pat.herring
Drawing Path: Y:\10627.003.0\acad\Reports_2011\RAP_2011\, Drawing Name: _tb_SVE Process Flow.dwg



Abbreviations

PI	Pressure Indicator
TI	Temperature Indicator
FE	Flow Element
FS	Flow Switch
LSL	Level Switch Low
LSH	Level Switch High
LSHH	Level Switch High High
LAHH	Level Alarm High High
SP	Sample Port

Key	
T-10	Knockout tank, 60 gallon 30-inch diameter
B-102	Positive displacement blower, Gardner-Denver HF624 75hp
V-104, V-105a	Vapor phase carbon absorber, Calgon Protect VS-8 1,000 (lbs), 12" inlet/outlet
P-106	Knockout tank transfer pump, Gould NPE 1STD4D4 3/4hp TEFC NPE
PI-103, PI-104, PI=105	Pressure Gauge 0-50 in. W.C.
PI-106	Pressure Gauge, 0-60 psi
SP-103, SP-104, SP-106, SP-108	Sample Port, 1/4 turn Lab Cock Valve 1/4" PVC
PI-010	Vacuum Gauge 0-120 IU. WC.

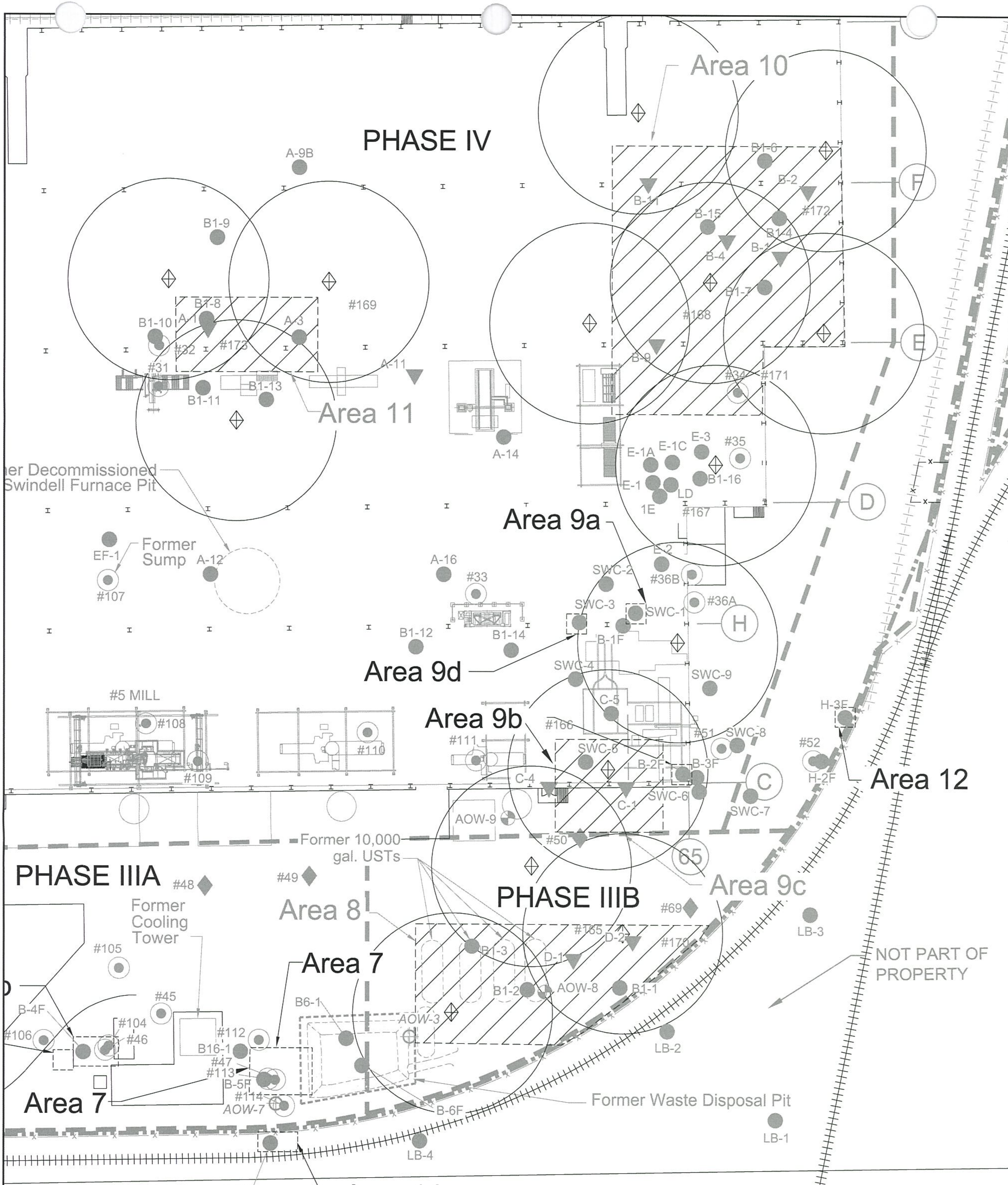
LEGEND

- Air system line
- Water system line
- Ball valve
- Lab cock valve
- Butterfly valve
- Check valve
- Y strainer
- Flow indicator
- SVE enclosure

PIPING AND INSTRUMENTATION DIAGRAM
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 10

Plot Date: 04/06/1… 0am, Plotted by: pat.herring
Drawing Path: Y:\1…03.0\acad\Reports_2011\RAP_2011\, Drawing Name: tb_PID_Phase1.dwg



Explanation

	Proposed soil vapor extraction/bioventing well locations
AOW-9	Groundwater monitoring well
AOW-3	Groundwater monitoring well destroyed
#109	Geomatrix soil boring
B-1	Approximate location of historical boring
D-1	Approximate location of historical CPT
C-1	Approximate location of historical vapor extraction well (destroyed 2006)
	Limits of work
	Phasing area boundary
	Railroad track (at grade)
	Chain link fence
BLDG	Building
	Proposed approximate area of soil vapor extraction
	Soil vapor extraction treatment system compound
	Radius of Influence 50 feet

N

0 25 50

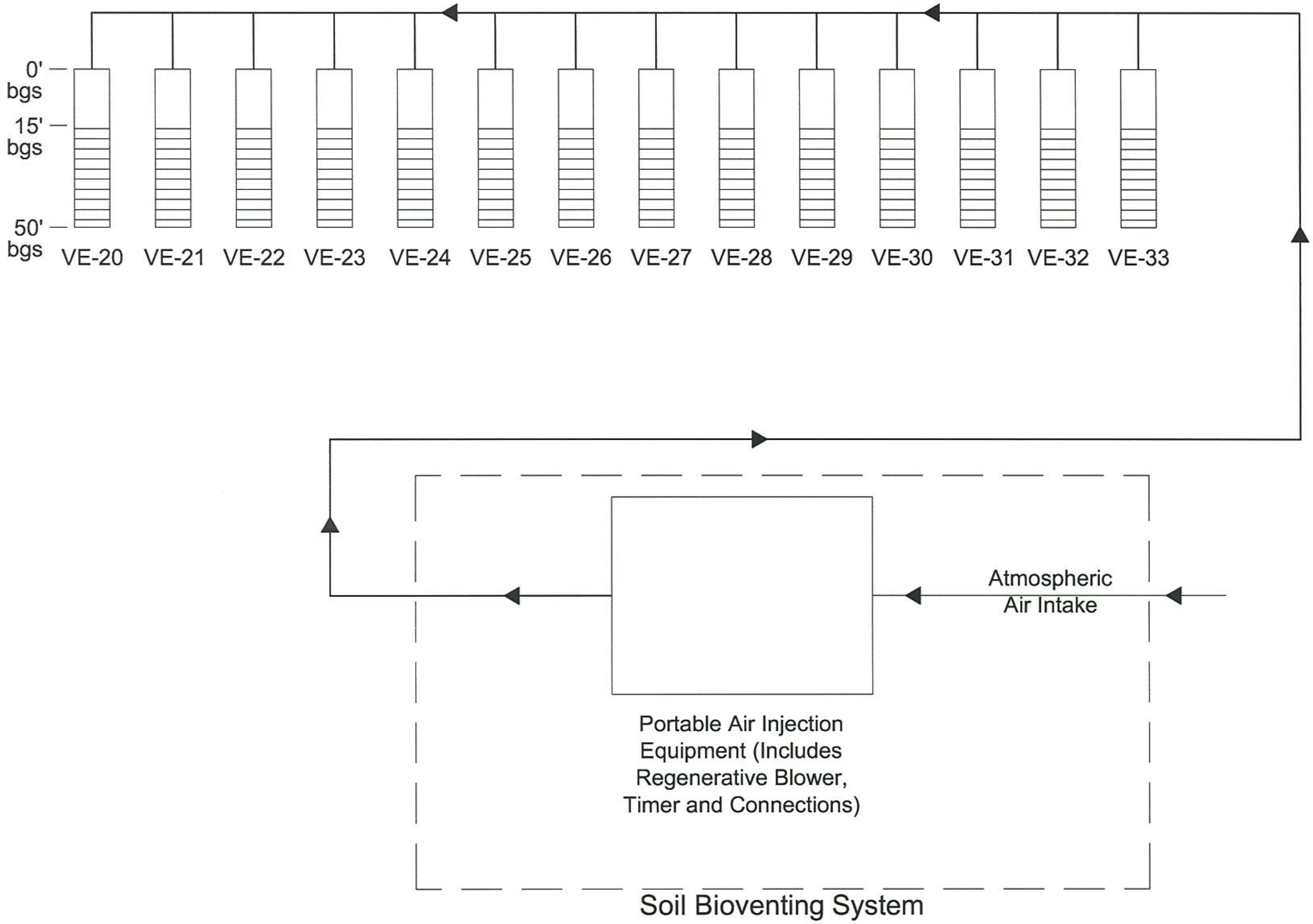
Approximate Scale in Feet

Basemap modified from Pechiney Cast Plate, Inc. Site Plan dated January 8, 2002, Geraghty & Miller, Inc. "Groundwater Elevation and Volatile Organic Compound Concentrations December 8, 1994" Figure dated February 2, 1995, Aluminum Company of America "Works General-Map" Figure dated October 10, 1984, and Los Angeles County Assessor's Office Parcel Map 6310 / Sheet 8 dated November 5, 1958.

PROPOSED SVE BIOVENTING WELL LOCATIONS
PHASE III AND IV AREAS
Former Pechiney Cast Plate, Inc. Facility
3200 Fruitland Avenue
Vernon, California

By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 11

Plot Date: 04/06/12 - 10:17am, Plotted by: pat.herring
Drawing Path: Y:\10627.003.0\acad\Reports_2011\RAP_2011\, Drawing Name: _tb_proposed SVE well locations.dwg



Note:

Initial SVE component of this remedy will be similar to the Process Flow Diagram shown on Figure 9.

Explanation

' = feet

bgs = below ground surface

PHASE III AND IV SOIL BIOVENTING PROCESS FLOW DIAGRAM Former Pechiney Cast Plate, Inc. Facility 3200 Fruitland Avenue Vernon, California		
By: pah	Date: 07/27/11	Project No. 10627.003
AMEC Geomatrix		Figure 12

APPENDIX A

Remedial Alternatives Cost Tables

Table A-1
Alternative #2
Excavation and Disposal of All COC-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Direct Capital Costs					
1	Mobilization/Demobilization	1	ls	$ 20,000	$ 20,000
2	Excavation Shoring	110,500	sqft	$ 35	$ 3,867,500
PCBs					
3	Excavate/Load	1,500	cy	$ 8	$ 12,000
4a	Transport and Dispose (PCB-Impacted Non-TSCA)	640	ton	$ 70	$ 44,800
4b	Transport and Dispose (TSCA >50 mg/kg, < 1000 mg/kg)	1,400	ton	$ 198	$ 277,200
4c	Transport and Dispose (TSCA > 1000 mg/kg)	200	ton	$ 295	$ 59,000
Metals					
5	Excavate/Stockpile/Load	70	cy	$ 8	$ 560
6a	Transport and Dispose - Non-Hazardous	95	ton	$ 44	$ 4,180
6b	Transport and Dispose Non-RCRA CA Hazardous	10	ton	$ 102	$ 1,020
VOCs and Stoddard Solvent					
7	Excavate/Stockpile/Load	159,200	cy	$ 8	$ 1,273,600
8a	Transport and Dispose Non-Hazardous	214,920	ton	$ 65	$ 13,969,800
8b	Transport and Dispose RCRA-Hazardous	23,880	ton	$ 134	$ 3,199,920
9	Stockpile and Confirmation Sampling	800	ea	$ 250	$ 200,000
10	Purchase and Import Fill	50,000	ton	$ 9	$ 450,000
11	Place and Compact Fill	40,000	ton	$ 9.25	$ 370,000
PCB-Impacted Concrete[6]					
12	Concrete Removal/Crush/Place (PCBs >1.0 mg/kg but <3.5 mg/kg)[7]	26,220	ft^3	$ 3	$ 78,660
13	Concrete Removal/Size/Load (PCBs >3.5 mg/kg but <50 mg/kg)	7,080	ft^3	$ 4	$ 28,320
14	Concrete Removal/Size/Load (PCBs >50 mg/kg)	2,020	ft^3	$ 4	$ 8,080
15	Stockpile and Confirmation Sampling	35	ea	$ 250	$ 8,830
16	Transport and Dispose (PCBs >3.5 mg/kg, but <50 mg/kg)	900	ton	$ 115	$ 103,500
17	Transport and Dispose (PCBs >50 mg/kg)	120	ton	$ 295	$ 35,400
18	Interim Cap	1	ls	$ 20,000	$ 20,000
Other					
19	Air Monitoring	1	ls	$ 20,000	$ 20,000
20	Health and Safety	1	ls	$ 20,000	$ 20,000
21	Other Non-Scheduled Contract Work	1	ls	$ 20,000	$ 20,000
				Direct Capital Total	$ 24,092,000

Table A-1
Alternative #2
Excavation and Disposal of All COC-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Indirect Capital Costs						
1	Construction Management	6%	of	$ 24,092,000	$	1,445,520
				Indirect Capital Subtotal	$	1,446,000
				Direct + Indirect Cost	$	25,538,000
				Bid Contingency (15% estimated contractor costs)	$	3,831,000
				Scope Contingency (15% estimated contractor costs)	$	3,831,000
				Contingencies	$	7,662,000
				Capital Total	**$**	**33,200,000**

Notes/Assumptions:
1. Excavation costs include SCAQMD Rule 1166 Monitoring.
2. Excavation shoring cost only includes areas proposed to be excavated at depths of 10 feet bgs or greater.
3. Soil stockpile confirmation sampling rate at one sample per 200 cy; concrete confirmation sampling rate at one sample per 1,000 ft^2.
4. Excavation and disposal will commence at a rate of 500 cy per day.
5. Backfill to be comprised of crushed recycled aggregate obtained from on-site demolition and crushing of former concrete structures. Unit cost for placement and compaction also includes crushing. Additional Purchase and Import Fill includes compaction.
6. PCB-Impacted Concrete includes removal and disposal of all concrete impacted with PCBs greater than 1.0 mg/kg. Demolition and removal costs associated with foundations, footings, pits, sumps, and other subsurface structures are excluded.
7. Concrete Removal/Crush/Place (PCBs >1.0 mg/kg, but <3.5 mg/kg) includes crushing, placement, and compaction.
8. PCB-impacted soil and concrete will be profiled based on TSCA requirements and direct-loaded into waste transport trucks for disposal. Based on the TSCA requirements, 70% of PCB-impacted soil will be disposed of as TSCA (>50 mg/kg) and 30% as non-TSCA (<50 mg/kg).
9. 90% of Metals-impacted soil excavated will be disposed of as Non-Hazardous. 10% of Metals-impacted soil excavated will be disposed of as RCRA-Hazardous.
10. 90% of VOC-impacted soil excavated will be disposed of as Non-Hazardous. 10% of VOC-impacted soil excavated will be disposed of as RCRA-Hazardous.
11. Soil Conversion Factor: 1.5 tons/cy.
12. Concrete slab removal is based on an average concrete slab thickness of 12 inches.
13. Density of Concrete is 150 lbs/ft^3.
14. No cost included for institutional controls such as deed restrictions which will include legal and administrative fees.
15. No cost included for engineering controls such as future vapor barrier requirements.
16. Bid and Scope contingencies derived from "A Guide to Developing and Documenting Remedial Alternative Cost Estimates During the FS," EPA, 2000.
17. ls = lump sum price.
18. sqft = square feet.
19. cy = cubic yard.
20. ea = each.
21. ft^3 = cubic feet.

Table A-2
Alternative #3
Excavation and Disposal of Shallow COC-Impacted Soil
SVE for Shallow and Deep VOC-Impacted Soil
SVE and Bioventing for Shallow and Deep Stoddard Solvent-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Direct Capital Costs					
1	Mobilization/Demobilization	1	ls	$ 5,000	$ 5,000
2	Excavation Shoring	4,300	sqft	$ 35	$ 150,500
PCBs					
3	Excavate/Load	1,500	cy	$ 8	$ 12,000
4a	Transport and Dispose (PCBs >1 mg/kg, but <50 mg/kg)	640	ton	$ 70	$ 44,800
4b	Transport and Dispose (PCBs >50mg/kg, but <1,000 mg/kg)	1,400	ton	$ 198	$ 277,200
4c	Transport and Dispose (PCBs >1,000 mg/kg)	200	ton	$ 295	$ 59,000
Metals					
5	Excavate/Stockpile/Load	70	cy	$ 8	$ 560
6a	Transport and Dispose - Non-Hazardous	95	ton	$ 44	$ 4,180
6b	Transport and Dispose - Hazardous	10	ton	$ 102	$ 1,020
PCB-Impacted Concrete[6]					
7	Concrete Removal/Crush/Place (PCBs >1.0 mg/kg but <3.5 mg/kg)[7]	26,220	ft^3	$ 3	$ 78,660
8	Concrete Removal/Size/Load (PCBs >3.5 mg/kg but <50 mg/kg)	7,080	ft^3	$ 4	$ 28,320
9	Concrete Removal/Size/Load (PCBs >50 mg/kg)	2,020	ft^3	$ 4	$ 8,080
10	Stockpile and Confirmation Sampling	35	ea	$ 250	$ 8,750
11	Transport and Dispose (PCBs >3.5 mg/kg, but <50 mg/kg)	900	ton	$ 115	$ 103,500
12	Transport and Dispose (PCBs >50 mg/kg)	120	ton	$ 295	$ 35,400
13	Interim Cap	1	ls	$ 20,000	$ 20,000
VOCs SVE					
14	Site Preparation	1	ls	$ 5,000	$ 5,000
15	SVE Well and Probe Installation	23	ea	$ 6,000	$ 138,000
16	Well Head Completion, Valves, Surface Seal	23	ea	$ 1,000	$ 23,000
17	Treatment System Manifold, Valves, Controls	1	ls	$ 6,000	$ 6,000
18	Auto-Dialer Control and Instrumentation	1	ls	$ 5,000	$ 5,000
19	Vapor-Phase GAC Vessels[14]	1	ls	$ 18,000	$ 18,000
20	Electrical Panel/Supply	1	ls	$ 15,000	$ 15,000
21	Temporary Hose and Piping	2,000	lf	$ 10	$ 20,000
22	Compound Gravel Pad, Fence Installation, Gates	1	ea	$ 8,000	$ 8,000
23	Treatment System Installation and Start-Up	1	ls	$ 20,000	$ 20,000
24	Laboratory Analysis	1	ls	$ 10,000	$ 10,000
25	Health and Safety	1	ls	$ 10,000	$ 10,000
26	System Decommission	1	ls	$ 25,000	$ 25,000
27	Other Non-Scheduled Contract Work	1	ls	$ 10,000	$ 10,000
Stoddard Solvent SVE and Bioventing					
28	Mobilization/Demobilization	1	ls	$ 10,000	$ 10,000
29	Site Preparation	1	ls	$ 5,000	$ 5,000
30	BioVent Well and Probe Installation	19	ea	$ 6,000	$ 114,000
31	Well Head Completion, Valves, Surface Seal	19	ea	$ 1,000	$ 19,000
32	Treatment System Manifold, Valves, Controls	1	ls	$ 6,000	$ 6,000
33	Auto-Dialer Control and Instrumentation	1	ls	$ 5,000	$ 5,000
34	Vapor-Phase GAC Vessels	1	ls	$ 18,000	$ 18,000
35	Electrical Panel/Supply	1	ls	$ 50,000	$ 50,000
36	Below-Grade Piping	2,250	lf	$ 15	$ 33,750
37	Compound Pad, Fence Installation, Gates	1	ea	$ 8,000	$ 8,000
38	Treatment System Installation and Start-Up	1	ls	$ 20,000	$ 20,000
39	Laboratory Analysis	1	ls	$ 10,000	$ 10,000
40	Health and Safety	1	ls	$ 10,000	$ 10,000
41	System Decommission	1	ls	$ 25,000	$ 25,000
42	Other Non-Scheduled Contract Work	1	ls	$ 10,000	$ 10,000
				Direct Capital Total	$ 1,494,000

Table A-2
Alternative #3
Excavation and Disposal of Shallow COC-Impacted Soil
SVE for Shallow and Deep VOC-Impacted Soil
SVE and Bioventing for Shallow and Deep Stoddard Solvent-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
	Indirect Capital Costs				
1	Permitting AQMD	5%	of	$ 313,000	$ 15,650
2	System Design	10%	of	$ 656,750	$ 65,675
3	Construction Management	6%	of	$ 1,494,000	$ 89,640
				Indirect Capital Subtotal	$ 171,000
				Direct + Indirect Cost	$ 1,665,000
				Bid Contingency (15% estimated contractor costs)	$ 250,000
				Scope Contingency (15% estimated contractor costs)	$ 250,000
				Contingencies	$ 500,000
				Capital Total	**$ 2,165,000**
Item No.	**Description**	**Estimated**	**Unit**	**Unit Cost**	**Estimated Cost**
	VOCs SVE and Stoddard Solvent SVE/Bioventing Annual Operation and Maintenance				
1	Equipment Rental	24	mths	$ 5,000	120,000
2	Operations & Maintenance	24	mths	$ 8,000	$ 192,000
3	Carbon Changeouts	32	ea	$ 3,000	$ 96,000
4	Electrical Fees	24	mths	$ 2,000	$ 48,000
5	Sampling & Analysis	24	mths	$ 2,000	$ 48,000
6	Production Water Disposal	24	mths	$ 4,000	$ 96,000
7	Project Management/Consultant support/Reports	24	mths	$ 4,000	$ 96,000
8	Health & Safety/Air Monitoring	24	mths	$ 1,000	$ 24,000
9	Miscellaneous	24	mths	$ 2,000	$ 48,000
10	DTSC Quarterly Status Report	4	ea	$ 10,000	$ 40,000
				Annual Operation and Maintenance Subtotal	**$ 808,000**
				Present Worth Factor (5%, 3 years)	2.72
				Present Worth of Operation and Maintenance	**$ 2,200,000**
	TOTAL CONSTRUCTION PLUS O&M FOR 3 YEARS				**$ 4,400,000**

Notes/Assumptions:
1. Excavation costs include SCAQMD Rule 1166 Monitoring.
2. Excavation shoring cost only includes areas proposed to be excavated at depths of 10 feet bgs or greater.
3. Soil stockpile confirmation sampling rate at one sample per 200 cy; concrete confirmation sampling rate at one sample per 1,000 ft.
4. Excavation and disposal will commence at a rate of 500 cy per day.
5. Backfill to be comprised of crushed recycled aggregate obtained from on-site demolition and crushing of former concrete structures.
Unit cost for placement and compaction also includes crushing. Additional Purchase and Import Fill includes compaction.
6. PCB-Impacted Concrete includes removal and disposal of all concrete impacted with PCBs greater than 1.0 mg/kg.
Demolition and removal costs associated with foundations, footings, pits, sumps, and other subsurface structures are excluded.
7. Concrete Removal/Crush/Place (PCBs >1.0 mg/kg, but <3.5 mg/kg) includes crushing, placement, and compaction.
8. PCB-impacted soil will be profiled based on TSCA requirements and direct-loaded into waste transport trucks for disposal.
Based on the TSCA requirements, 70% of PCB-impacted soil will be disposed of as TSCA (>50 mg/kg) and 30% as non-TSCA (<50 mg/k
9. 90% of Metals-impacted soil excavated will be disposed of as Non-Hazardous.
10% of Metals-impacted soil excavated will be disposed of as RCRA-Hazardous.
10. Soil Conversion Factor: 1.5 tons/cy.
11. Concrete slab removal is based on an average concrete slab thickness of 12 inches.
12. Assume 1,000 SCFM minimum for SVE system.
13. Total system operation costed for a period of one year; for purposes of O&M cost estimation, assume system run time of three years.
14. SVE = Soil Vapor Extraction.
15. Dual 1,000 pound vapor phase granular activated carbon (GAC) vessels for SVE system.
16. AQMD = Southern California Air Quality Management District.
17. No cost included for institutional controls such as deed restrictions which will include legal and administrative fees.
18. No cost included for engineering controls such as future vapor barrier requirements.
19. Bid and Scope contingencies derived from "A Guide to Developing and Documenting Remedial Alternative Cost Estimates During the FS," EPA, 2000.
20. ls = lump sum price.
21. sqft = square feet.
22. cy = cubic yard.
23. ea = each.
24. lf = linear feet.
25. mths = months.
26. ft^3 = cubic feet.

Table A-3
Alternative #4
In Situ Stabilization of Shallow PCB/Metals-Impacted Soil and Deep Stoddard Solvent-Impacted Soil
SVE for Shallow and Deep VOC-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete

Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Direct Capital Costs					
PCB, Metals, and Stoddard Solvent Stabilization					
1	Mobilization/Demobilization	1	ls	$ 100,000	$ 100,000
2	Site Preparation	1	ls	$ 10,000	$ 10,000
3	In-Situ Stabilization	48,000	cy	$ 135	$ 6,480,000
4	Confirmation Sampling	240	ea	$ 250	$ 60,000
5	Air Monitoring	1	ls	$ 15,000	$ 15,000
6	Excess Cuttings Disposal	14,400	ton	$ 70	$ 1,008,000
7	Health and Safety	1	ls	$ 10,000	$ 10,000
8	Other Non-Scheduled Contract Work	1	ls	$ 50,000	$ 50,000
PCB-Impacted Concrete[6]					
9	Concrete Removal/Crush/Place (PCBs >1.0 mg/kg but <3.5 mg/kg)[7]	26,220	ft^3	$ 3	$ 78,660
10	Concrete Removal/Size/Load (PCBs >3.5 mg/kg but <50 mg/kg)	7,080	ft^3	$ 4	$ 28,320
11	Concrete Removal/Size/Load	2,020	ft^3	$ 4	$ 8,080
12	Stockpile and Confirmation Sampling	35	ea	$ 250	$ 8,830
13	Transport and Dispose (PCBs >3.5 mg/kg, but <50 mg/kg)	900	ton	$ 115	$ 103,500
14	Transport and Dispose (PCBs >50 mg/kg)	120	ton	$ 295	$ 35,400
15	Interim Cap	1	ls	$ 20,000	$ 20,000
VOCs SVE					
16	Site Preparation	1	ls	$ 5,000	$ 5,000
17	SVE Well and Probe Installation	23	ea	$ 6,000	$ 138,000
18	Well Head Completion, Valves, Surface Seal	23	ea	$ 1,000	$ 23,000
19	Treatment System Manifold, Valves, Controls	1	ls	$ 6,000	$ 6,000
20	Auto-Dialer Control and Instrumentation	1	ls	$ 5,000	$ 5,000
21	Vapor-Phase GAC Vessels	1	ls	$ 18,000	$ 18,000
22	Electrical Panel/Supply	1	ls	$ 15,000	$ 15,000
23	Temporary Hose and Piping	2,000	lf	$ 10	$ 20,000
24	Compound Gravel Pad, Fence Installation, Gates	1	ea	$ 8,000	$ 8,000
25	Treatment System Installation and Start-Up	1	ls	$ 20,000	$ 20,000
26	Laboratory Analysis	1	ls	$ 10,000	$ 10,000
27	Health and Safety	1	ls	$ 10,000	$ 10,000
28	System Decommission	1	ls	$ 25,000	$ 25,000
29	Other Non-Scheduled Contract Work	1	ls	$ 10,000	$ 10,000
				Direct Capital Total	$ 8,329,000
Indirect Capital Costs					
1	Permitting AQMD	5%	of	$ 8,329,000	$ 416,450
2	System Design	10%	of	$ 8,329,000	$ 832,900
3	Construction Management	6%	of	$ 8,329,000	$ 499,740
				Indirect Capital Subtotal	$ 1,749,000
				Direct + Indirect Cost	$ 10,078,000
				Bid Contingency (15% estimated contractor costs)	$ 1,512,000
				Scope Contingency (15% estimated contractor costs)	$ 1,512,000
				Contingencies	$ 3,024,000
				Capital Total	**$ 13,102,000**

Table A-3
Alternative #4
In Situ Stabilization of Shallow PCB/Metals-Impacted Soil and Deep Stoddard Solvent-Impacted Soil
SVE for Shallow and Deep VOC-Impacted Soil
Demolition and Disposal of PCB-Impacted Concrete
Former Pechiney Cast Plate, Inc., Facility
Vernon, California

Item No.	Description	Estimated	Unit	Unit Cost	Estimated Cost
	Annual Operation and Maintenance				
1	Equipment Rental	12	mths	$ 5,000	$ 60,000
2	Operations & Maintenance	12	mths	$ 8,000	$ 96,000
3	Carbon Changeouts	16	ea	$ 3,000	$ 48,000
4	Electrical Fees	12	mths	$ 2,000	$ 24,000
5	Sampling & Analysis	12	mths	$ 2,000	$ 24,000
6	Production Water Disposal	12	mths	$ 4,000	$ 48,000
7	Project Management/Consultant Support/Reports	12	mths	$ 4,000	$ 48,000
8	Health & Safety/Air Monitoring	12	mths	$ 1,000	$ 12,000
9	Miscellaneous	12	mths	$ 2,000	$ 24,000
10	DTSC Quarterly Status Report	4	ea	$ 10,000	$ 40,000
	Annual Operation and Maintenance Subtotal				**$ 424,000**
	Present Worth Factor (5%, 3 years)				2.72
	Present Worth of Operation and Maintenance				**$ 1,155,000**
	TOTAL CONSTRUCTION PLUS O&M FOR 3 YEARS				**$ 14,300,000**

Notes/Assumptions:
1. Mobilization includes Crawler-mounted large diameter augers.
2. Assume ~10 percent cement additive. Actual mix design would be performed during Design with necessary cement percentage based on leachability.
3. Stockpile confirmation sampling rate at one sample per 200 cubic yards.
4. Stabilization rate of 300 cubic yards per day.
5. PCB-Impacted Concrete includes removal and disposal of all concrete impacted with PCBs greater than 1.0 mg/kg. Demolition and removal costs associated with foundations, footings, pits, sumps, and other subsurface structures are excluded.
6. Concrete Removal/Crush/Place (PCBs >1.0 mg/kg, but <3.5 mg/kg) includes crushing, placement, and compaction.
7. No cost included for institutional controls such as deed restrictions which will include legal and administrative fees.
8. No cost included for engineering controls such as future vapor barrier requirements.
9. Cost assumes 20 percent of mixed volume requires off-site disposal.
10. Assume 1,000 SCFM minimum for SVE system.
11. Total system operation for a period of one year; for purposes of cost estimation, assumes system run time of three years.
12. SVE = Soil Vapor Extraction.
13. Dual 1,000 pound vapor phase granular activated carbon (GAC) vessels for SVE system.
14. AQMD = Southern California Air Quality Management District.
15. Soil Conversion Factor: 1.5 tons/cy.
16. Concrete Slab removal is based on an average concrete slab thickness of 12 inches.
17. Density of Concrete is 150 lbs/ft^3.
18. No cost included for institutional controls such as deed restrictions which will include legal and administrative fees.
19. No cost included for engineering controls such as future vapor barrier requirements.
20. Bid and Scope contingencies derived from "A Guide to Developing and Documenting Remedial Alternative Cost Estimates During the FS," EPA, 2000.
21. ls = lump sum price.
22. cy = cubic yard.
23. ea = each.
24. lf = linear feet.
25. mths = months.
26. ft^3 = cubic feet.

APPENDIX B

Below-Grade Demolition and Soil Excavation Technical Specifications

Table of Contents
Below Grade Demolition and Soil Remediation
Construction Specifications
Former Pechiney Cast Plate Inc.
Vernon, CA

SECTION	TITLE
Division 1	**General Requirements**
01100	Summary of Work
01275	Measurement and Payment
01290	Schedule of Values
01330	Submittals and Procedures
01500	Temporary Facilities and Controls
01501	Dust Controls
01502	Storm Water Management
01510	Mobilization and Demobilization
01550	Traffic Control
01560	Site Security
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Division 2	**Technical Specifications**
02050	Demolition
02110	Excavation of Contaminated Materials
02114	Soil and Waste Stockpiling
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02260	Excavation Support and Protection
02351	Backfilling and Grading

SECTION 01110

SUMMARY OF WORK

PART 1 – GENERAL

1.01 DEFINITIONS

A. The following definitions are used in the specifications and supplement the General Conditions of the Contract.

1. CONTRACTOR shall mean the prime service provider contracted directly with OWNER.

2. ENGINEER shall mean AMEC Geomatrix, Inc.

3. OWNER shall mean Pechiney Cast Plate, Inc.

4. Site shall mean the former Pechiney Cast Plate Facility and Property located at 3200 Fruitland Avenue in Vernon, California.

5. ALCOA shall mean former Site Owner who operated the facility prior to 1999.

6. Contract Documents shall mean Instructions to Contractors, The Proposal Form, and the Contract Documents (including specifications, drawings, historic drawings, and all Addenda issued prior to recipient of proposals as well as Change Orders, Contractor Submittals, and other Addenda issued after award of Contract.)

7. Project Record Documents shall refer to As-Built records and Drawings to be maintained by the CONTRACTOR at the Site for submittal to the ENGINEER upon completion of the Work.

8. COPCs shall mean Constituents of Potential Concern.

9. Below Grade shall mean the depth below the natural grade of the Site that corresponds to the current parking lot surfaces along the east side of the former buildings (graded for stormwater control). Below Ground Surface (bgs) shall refer to the depth below the soil surface at the Site. This definition typically refers to deeper lithologic units as determined from previous Site characterization activities. The elevation of the parking lot pavement ranges from approximately 186 to 177 - feet above mean sea level (msl) (NAVD 88).

10. Slab Grade shall mean the top of floor slabs of the former buildings are at an approximate elevation of 187 - feet msl.

11. PCBs shall mean polychlorinated biphenyls.

12. VOCs shall mean volatile organic compounds.

13. SWPPP shall mean Stormwater Pollution Prevention Plan.

14. PCCP shall mean Portland cement concrete pavement.

15. ACP shall mean asphalt concrete pavement.

16. Drawings shall mean design sheets G-1 to G-9B.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General Conditions apply to the Work of this Section.

B. Section 01330 – Submittals and Procedures

1.03 PROJECT BACKGROUND

Pechiney Cast Plate, Inc. (Pechiney) closed its facility located in Vernon, California. The property occupies approximately 27 acres. Pechiney (OWNER) recently demolished the existing aboveground facilities and improvements down to concrete Slab Grade as part of the agreement to sell the property to the City of Vernon (City). AMEC Geomatrix , Inc. (ENGINEER) was the OWNER'S consultant and Site manager for that project.

1.04 EXISTING SITE CONDITIONS

All aboveground structures have been demolished. Former building floor slabs, foundations, footings, pits, sumps, and pavement surfaces remain in place. The former buildings, which included the Casting Building (104) and Processing Buildings (106, 108, 110, 112, 112A) occupied approximately 14 of the 27 acres. The building floor slabs are reinforced concrete approximately 9 to 12 inches thick on partially raised grade (the concrete may be thinner or thicker in some areas). Many building slabs, which formerly contained wood block flooring over concrete, were replaced with predominantly a concrete overlay; in some areas, the overlay is asphalt. Steel rails or tracks are embedded in the floor slab throughout the building. The building slabs are underlain by buried concrete foundation column and footing structures ranging in depth from 4 to 12 feet below Slab Grade. There are several equipment foundation pits ranging from 4 to 70 feet in depth below Slab Grade. In addition, several foundations for former equipment and concrete pipe ducts are present at the Site. There are no known basements present.

The remainder of the property is presently paved with approximately equal areas with asphalt (approximately 245,000 square feet) and concrete (approximately 175,000 square feet). The roadway and parking lot pavement thicknesses vary. The average asphalt thickness is approximately 3 inches and the average concrete thickness is approximately 9 inches. The CONTRACTOR may assume that the concrete roadway pavements outside of former building footprints are un-reinforced. Several rail spurs are present on-Site, two of which are not owned by Pechiney and are excluded from this project. Some of the railroad tracks are buried Below Grade.

Historically, lubricating oil that contained PCBs was used and the lubricating oil impacted some of the concrete slab surfaces and subsurface soil. In addition to PCBs, metals and VOCs comprised of TCE and PCE, and Stoddard Solvents are present in several subsurface soil areas throughout the Site at various concentrations. Three groundwater monitoring wells are also present at the Site.

1.05 SUBSURFACE CONDITIONS

Previous subsurface investigations suggest the Site is underlain by fine-grained (predominantly silt) and coarse-grained (predominantly sand) sediments (referred to by others as Recent Alluvium) from ground surface to approximately 40 - feet below ground surface (bgs). Below this material is predominantly silt and clay (referred to by others as the Bellflower aquitard) from approximately 40 to 85 feet bgs, and predominantly sand (referred to by others as the Lakewood Formation) to a depth of at least 161.5 feet. The deepest boring drilled at the Site is 161.5 feet, according to documents reviewed by Geomatrix (Geraghty & Miller, 1991). The depth to groundwater at the Site is approximately 150 feet Below Grade.

1.06 CONTRACT SCOPE

A. Removal of slabs, pavements, and Below Grade structures, and the excavation of impacted soil are included in this Below Grade Demolition and Soil Excavation Scope of Work.

B. CONTRACTOR shall provide all necessary labor, materials, equipment, tools, supplies, and protective equipment as required to affect a complete and finished job acceptable to ENGINEER and OWNER and in compliance with all applicable Laws and Regulations. In general, the Work consists of demolition of slabs, pavements and subsurface structures, excavation and off-Site disposal of VOC, PCB, and metals -impacted soil, removal and off-Site disposal of PCB-impacted concrete slabs, pavements, and subsurface features, backfilling, and rough grading the Site to the lines and grades shown in the Drawings. Specifically, Work under this Contract includes, but is not limited to, the following tasks:

1. Developing submittals, obtaining all required permits, and making all necessary Agency notifications. Submittals include Work Plans, health and safety plans, progress schedules, quality control plans, payment schedules and others as defined in the Contract Documents. Permits are summarized in Part 1.16 below. Submittals are included in Section 01330.

2. Mobilization and Site preparation, including installation of CONTRACTOR'S temporary facilities and controls, Site services, Site security, and stormwater

management and controls. The stormwater management systems at the Site consist of collection piping and catch basins. The primary stormwater system located within the eastern parking lot shall be left in place during Below Grade Demolition. Stormwater Best Management Practices (BMPs) shall be maintained throughout the Below Grade Demolition and Soil Excavation Work. Maintenance and monitoring of stormwater BMPs shall be terminated following receipt of the Closure Certification from the City. Upon Site closure, stormwater management will become the responsibility of the future property owner.

3. Demolition of former building slabs and pavement surfaces as shown on the Drawings.

4. Below Grade Demolition and removal of man-made structures, footings, foundations, pits, and sumps within the footprint of the former buildings, and other specific structures located adjacent to the former building areas. Structure types and associated removal depths Below Grade are summarized below:

   a. Building Foundations and Footings: A majority of the building foundation footings extend to a depth of 11 to 12 - feet below the floor slab. All building foundation footings shall be removed in their entirety during demolition, unless the foundation footings are attached to deeper concrete structures that prevent their complete removal. If this is the case, structures shall be removed to 10 - feet Below Grade and the horizontal and vertical locations of the top portions of remaining structures deeper than 10 - feet shall be backfilled in place, surveyed and documented in the Project Record Documents.

   b. Man-made structures (other than building foundation footings) such as pits and sumps are present within the former building footprints and located within the upper 10 - feet Below Grade that were associated with Pechiney Cast Plate's previous operations. These structures shall be demolished in their entirety.

   c. Deeper portions of man-made structures such as vertical pits that extend beyond 10 - feet Below Grade shall be demolished to a depth of 10 - feet Below Grade and the remaining deeper portion of the structure shall be pierced in their floor to facilitate drainage of any water that may collect in the pit, followed by backfilling with Pea Gravel, mechanically vibrated as it is placed, then capped with cement concrete.

   d. Portions of previously backfilled-in-place man-made subsurface structures that extend deeper than 10 - feet Below Grade and are located beneath the former building footprints, shall be demolished to a depth of 10 - feet Below Grade. Reportedly, these deeper structures were decommissioned in place by ALCOA during previous facility closure activities, with approval granted by the City of Vernon, by backfilling with Pea Gravel (or similar material) and capping at or near the surface with concrete. The upper portions of these deeper structures shall be demolished from slab grade to a depth of 10 - feet Below Grade and the remaining deeper portions shall be capped with concrete and left undisturbed. If present, previously backfilled material shall be recovered from these structures and set aside for use as backfill pending analysis from ENGINEER. Horizontal and vertical locations of the top of these exposed structures shall be surveyed and recorded on the Project Record Drawings.

5. Removal and/or backfilling of subsurface utilities and pipelines. Utilities and pipelines located within 3 - feet Below Grade shall be removed. Other utilities, such as sewer lines, pipelines, electrical conduits, utility piping, and others, that are present at depths exceeding 3 - feet Below Grade shall be backfilled in place by filling them with cement slurry. Stormwater system piping shall be maintained in its existing condition to the extent practicable and as required to comply with the Stormwater Pollution Prevention Plan (SWPPP). Exploration trenching shall not be conducted to locate utilities that remain in place or utilities that were filled with slurry. Those utilities not being used in performance of Below Grade Demolition Work shall be cut and capped at the property boundary. Other utilities such as select storm drains (**excluding** the on-Site storm drain catch basins in the Phase VI area and their connection to outfall #8 that discharges at Alcoa Avenue) and sewer connections employed during Below Grade Demolition and Soil Excavation Work shall be cut and capped at the property boundary prior to the completion of Site Work. The points where known utilities enter the property or where utilities are encountered during Below Grade Demolition Work shall be documented on a map and made part of the Project Record Documents;

6. Excavation, staging and stockpiling, and off-Site disposal of soils impacted with PCBs, TPH, metals, and VOCs. Soil excavation in PCB-impacted areas shall extend to approximately 12 - feet below slab grade. Soil excavation in specific VOC-impacted areas shall extend to approximately 12 - feet Below Grade as needed to remove footings, or as directed by ENGINEER. All soil excavation Work shall comply with South Coast Air Quality Management District (AQMD) requirements including AQMD Rule 1166 monitoring. Some excavation areas shall require shoring.

7. Removal, handling, loading, and off-Site disposal of concrete impacted with PCBs. PCB-impacted concrete removed shall be direct loaded into hauling vehicles for disposal. All PCB-impacted concrete removal Work shall comply with Toxic Substances Control Act (TSCA) 40 CFR 761.

8. On-Site crushing of concrete debris associated with demolition activities for reuse on-Site as backfill. Recycled, crushed aggregates obtained from on-Site crushing shall be comprised of crushed, recycled PCCPs that do not contain COPCs at concentrations exceeding risk-based regulatory screening levels. Asphalt debris shall be transported offsite for recycling or disposal as a solid waste. Concrete debris

containing PCBs greater than 1 mg/kg, but less than 3.5 mg/kg shall be handled and stockpiled as a TSCA waste. CONTRACTOR shall segregate and pulverize all concrete containing PCBs greater than 1 mg/kg, but less than 3.5 mg/kg for reuse as Restricted Use fill and placement in areas shown on the Drawings. CONTRACTOR shall segregate and stockpile asphalt, concrete debris, and PCB-impacted concrete debris separately.

9. Backfilling and compacting of subsurface structure removal areas and soil excavation areas with recycled crushed aggregates and backfill material recovered from previously backfill subsurface features extending to 10-feet Below Grade.. Backfilling of select deeper pits with imported Pea Gravel. Crushed concrete placed as Restricted Use fill shall be covered with an interim cap as shown on the Drawings.

10. Rough Site Grading. After removal of all structures and completion of Soil Excavation Work, the Site shall be rough graded for the purposes of contouring the surface for drainage control and to minimize ponding, and eliminating open trenches or excavations that could pose a safety hazard. Because soil excavation Work shall be performed as part of Below Grade Demolition, the final rough grades will be topographically different than the approximate elevations of the existing ground surface due to the net export of soil and other wastes from the Site. Restricted and Unrestricted recycled crushed concrete aggregates shall be used as backfill, in conjunction with existing soil to grade the Site as indicated in the Drawings.

11 All Work activities described in the Contract Documents shall be performed in compliance with applicable sections of California Code of Regulations (CCR) Industrial Safety Orders (Title 8), as well as federal and state OSHA regulations and Rio Tinto HSE Performance Standards identified in Section 01900 – Health and Safety Requirements. Prior to beginning field activities, a Site-specific Health and Safety Plan (HASP) will be prepared. A full-time, project-dedicated Site Safety Supervisor (SSS) working under the direct oversight of a Certified Industrial Hygienist (CIH) will be present on-Site to conduct and or supervise worker and perimeter air and dust monitoring during Below Grade Demolition Work. In addition, the SSS will monitor Site Work to verify compliance with applicable health, safety, and environmental regulations and permit requirements.

12. All surveying as specified in the Contract Documents.

1.07 FORM OF SPECIFICATIONS

The Work is shown on the Drawings and is further defined in the Specifications herein. Minor and related Work not described or shown, but necessary to the completion of the Work in all respects shall be the responsibility of CONTRACTOR and performed at no additional cost to OWNER or cause of any delay to the Work.

1.08 CONTRACTS

Perform Work under a single Contract with OWNER.

1.09 MILESTONES (WORK SEQUENCE)

A. CONTRACTOR shall perform Work in phases to accommodate traffic control, deeper remediation to be performed by others, and proposed Site redevelopment requirements. Project phasing is shown on the Drawings. CONTRACTOR shall coordinate the Construction Progress Schedule and operations with ENGINEER as described in Section 01330. CONTRACTOR shall:

1. Upon Notice to Proceed (NTP) CONTRACTOR shall prepare required submittals and submit to ENGINEER for review and or acceptance within 12 calendar days. CONTRACTOR shall also initiate any necessary project permit applications.

2. Mobilize and begin Work within 30 calendar days of receiving NTP and implement all requirements of Section 01500. Except where otherwise approved, no demolition or remediation is to take place without a directive from both the City of Vernon Health & Environmental Control (H&EC) and the Department of Toxics Substance Control (DTSC). No demolition or remediation is to take place in PCB-impacted areas without approval from US EPA, or as directed by ENGINEER.

3. Initiate and perform removal, direct-loading and off-site disposal of TSCA-regulated PCB-impacted concrete present in certain Phase areas as defined in the Contract Documents for concrete that contains PCB concentrations that exceed the risk-based remediation level.

4. Initiate and perform all Work in the Phase I area as defined in the Contract Documents. Phase I Work includes all Below Grade Demolition and Soil Excavation Work in the former building footprint areas located north of the Column 21 Demarcation Line. Upon completion of slab and pavement demolition and removal in Phase I, CONTRACTOR is allowed to continue with slab and pavement demolition and removal in Phase II areas, and subsequent Phase III and Phase V areas. Upon completion of foundation and footing demolition and removal in the Phase I area, CONTRACTOR is allowed to continue with foundation and footing demolition and removal in Phase II areas, and subsequent Phase III areas. CONTRACTOR shall complete all Work in the Phase I area, excluding Backfilling and Grading, within 40 calendar days after Mobilization. Installation of soil vapor extraction systems in the Phase I area will be competitively bid by Pechiney. Upon CONTRACTOR completion of Backfilling and Grading, deeper soil vapor extraction remediation system well installation will then be installed in the Phase I area by others.

5. Perform all Work in the Phase II area as defined in the Contract Documents. Phase II Work includes all Below Grade Demolition and Soil Excavation Work in the former building footprint areas located north of the Column 46 Demarcation Line up to the Phase I southern boundary. CONTRACTOR shall complete all Work in the Phase II area, except backfilling and Grading, within 90 calendar days after Mobilization.

6. Perform all Work in the Phase III area as defined in the Contract Documents. Phase III includes the southwest portion of the Site south of former Building 104 and west of former Building 112A, in the vicinity of the former Cooling Tower and Hot Well.

7. Perform all Work in the Phase V area as defined in the Contract Documents. Phase V includes the Parcel 6 area located south of the railroad tracks.

8. No Below Grade Demolition or Soil Excavation Work shall be performed in the Phase IV area until after completion of two months operation of soil vapor extraction remediation activities in the Stoddard solvent-impacted areas. Installation of soil vapor extraction and bioventing systems in the Stoddard solvent-impacted areas will be competitively bid by Pechiney, and bioventing require up to three years to reach completion. Upon completion of two months of soil vapor extraction operations, Below Grade Demolition and Soil Excavation Work shall then be performed in the Phase IV area in a manner consistent with the requirements for similar work in adjacent areas of the Site as described in these Contract Documents. Upon CONTRACTOR'S completion of the demolition and grading work in Phase IV, additional wells will be installed in the Phase IV area by others as related to the longer term bioventing system operations.

9. Below Grade Demolition and Soil Excavation Work shall be performed in the Phase VI area as defined in the Contract Documents.

10. Perform all remaining Work in other areas of the Site as defined in the Contract Documents.

11. Complete all Below Grade Demolition Work within 120 calendar days of Mobilization.

1.10 MEANS AND METHODS

A. Means and methods of Work performance shall be such as CONTRACTOR may choose; subject, however, to Laws and Regulations and ENGINEER'S and OWNER'S right to reject means and methods proposed which:

1. Will not produce finished Work in accordance with the terms of the Contract.

2. Are contrary to specific means or method included in the Contract.

A. The right to reject means and methods of a CONTRACTOR shall not be construed or interpreted as acceptance or control of means and methods by ENGINEER.

B. ENGINEER'S or OWNER'S approval or failure to expedite the right to reject means and methods shall not relieve CONTRACTOR of his obligation to complete the Work required by the Contract.

C. Total responsibility for control of all means and methods lies with CONTRACTOR for all Work for which it is responsible.

1.11 SUBCONTRACTORS

CONTRACTOR shall not award any Work to any Subcontractor without prior written approval of OWNER.

1.12 PROJECT MEETINGS

Pre-Construction Meeting: After award of Contract, at a time designated by OWNER or ENGINEER, CONTRACTOR shall attend a Pre-Construction Meeting. Procedures to be followed, critical work sequencing, submittals, coordination efforts, Contract payments, and similar matters will be reviewed.

Progress Meetings: During construction, periodic Site meetings will be held with CONTRACTOR, major Subcontractors, OWNER, and ENGINEER. These meetings will be held weekly (unless job conditions do not warrant) and may be held more frequently if job progress and needs indicate. CONTRACTOR and major Subcontractors shall have one or more responsible representatives in attendance. CONTRACTOR shall submit a Progress Report to ENGINEER at least one working day prior to the Progress Meeting. The Progress Report shall be completed by CONTRACTOR as specified in Section 01275.

1.13 SPECIAL CONDITIONS

A. Upon execution of the Agreement, CONTRACTOR acknowledges full understanding of the nature and location of the Work, the general and local conditions, particularly those bearing upon availability of labor, water, electric power, roads, uncertainties of weather or similar physical conditions at the Site, the conformation and conditions of the subsurface features due to historic activities, groundwater conditions, the character of equipment and facilities needed preliminary to and during the prosecution of the Work, and all other matters which can in any way affect the Work or the cost thereof under this Contract.

B. CONTRACTOR further acknowledges satisfaction as to character, quality and quantity of surface and subsurface materials to be encountered from its inspection of the Site and from reviewing records of exploratory Work made available by OWNER. Failure by CONTRACTOR to become acquainted with the physical conditions of the Site and all the available information will not relieve CONTRACTOR from responsibility for properly estimating the difficulty or cost of successfully performing the Work.

Information is available regarding the locations and concentrations of COPCs detected at the Site. Copies of the document will be made available to bidders for their review. Failure by CONTRACTOR to become acquainted with all the available information will not relieve CONTRACTOR from responsibility for properly estimating the difficulty or cost of successfully performing the Work. In the event of a conflict between information in the reference documents listed below and the Specifications and Drawings, the Specifications and Drawings shall govern. The documents that will be provided are:

1. Phase II Environmental Site Assessment Report, Pechiney Cast Plate Facility, Vernon, California, March 9, 2006; Geomatrix Consultants, Inc;

2. Supplemental Phase II Environmental Site Assessment Report Addendum, Pechiney Cast Plate Facility, Vernon, California, December 19, 2006; Geomatrix Consultants, Inc;

3. Draft Feasibility Study and Remedial Action Plan
Former Pechiney Cast Plate, Inc., Facility, Vernon, California;
2009; AMEC Geomatrix, Inc.

4. Hazardous Materials Transportation Plan
Former Pechiney Cast Plate, Inc., Facility, Vernon, California;
2010; AMEC Geomatrix, Inc.

5. Historical Facility Drawings.

C. CONTRACTOR warrants that as a result of examination and investigation of all the aforesaid data, CONTRACTOR can perform the Work in a professional and workmanlike manner and to the satisfaction of OWNER. OWNER assumes no responsibility for any representations made by any of its officers or agents during or prior to the execution of this Contract, unless (1) such representations are expressly stated in the Contract and (2) the Contract expressly provides that the responsibility is assumed by OWNER.

1.14 CONTRACTOR'S ACCESS AND USE OF SITE

A. Allowable Site working hours for performing Work: 6:00 A.M. to 6:00 P.M. on weekdays unless otherwise approved by OWNER or ENGINEER. CONTRACTOR shall notify ENGINEER of any anticipated weekend Work one week in advance. Weekend Work must be approved by ENGINEER.

B. CONTRACTOR shall allow OWNER, ENGINEER, and regulatory agency personnel access to the Site at all times.

C. CONTRACTOR shall keep Site free from accumulation of surplus materials and rubbish resulting from the Work.

D. CONTRACTOR shall take all steps necessary to avoid depositing debris and mud on roads and streets adjoining, or on the Site, from vehicles and equipment operating to and from the construction Site during the Work. CONTRACTOR shall also be responsible for removal of such debris by brooming and washing on a daily basis and additionally, immediately upon notice by ENGINEER or governmental authorities.

E. CONTRACTOR'S failure to comply with these requirements within 2 hours after being given notice by ENGINEER or governmental agency, will result in OWNER having the streets cleaned and deducting the costs of such cleaning from the amount due to CONTRACTOR.

1.15 WORK PERFORMED BY OTHERS

A. CONTRACTOR shall coordinate the progress of their Work with that being performed by others in areas where common usage of roads or other areas of the Site is required. CONTRACTOR shall allow reasonable access and implementation of deeper soil remediation activities by others as described in Part 1.09 Milestones (Work Sequence). Deeper soil remediation Work will include installation and operation of a soil vapor extraction (SVE) system in the Phase I area of the Site and a SVE and Bioventing system in the Phase III/IV areas of the Site.

B. ENGINEER will operate a temporary on-Site SVE system located in the Phase III/IV area of the Site.

C. CONTRACTOR shall provide access for the ENGINEER'S surveyor to enter active Work zones to survey and record ENGINEER'S soil sample locations.

D. CONTRACTOR shall provide access for the ENGINEER'S concrete coring subcontractor to enter active Work zones to assist ENGINEER in collection of concrete core samples.

1.16 PERMITS AND NOTIFICATIONS

All project permits and notifications are the responsibility of the CONTRACTOR. The known permits and notifications for this project include:

Permit/Submittal	Agency
Demolition Permit	City of Vernon
Permit to Disconnect/Terminate Utilities (Fire Service, Electrical, Sewer, Storm Drain etc.)	City of Vernon and other Utility Agencies

Permit/Submittal	Agency
Demolition Permit and 10-day Notification	SCAQMD and City of Vernon
Rule 403 and 404 Permit and Notifications	SCAQMD and City of Vernon
Demolition Permit	City of Vernon
Excavation Permit (Include Shoring Plans)	California – Occupational Safety and Health Administration (Cal-OSHA)
Grading Permit (Include Shoring Plans)	City of Vernon
Notice of Intent (NOI)	State of California and City of Vernon
Storm Water Pollution Prevention Plan	State of California and City of Vernon
Permit to use Fire Hydrant Water	City of Vernon
Permit to use crushed concrete as backfill	City of Vernon
Final Grading Plan and Standard Urban Storm Water Mitigation Plan	State of California and City of Vernon
Traffic Control (Detour) Plan	City of Vernon
Encroachment Permit	City of Vernon
Permit to Work Near Railroad	Railroad Owner
Transportation Plan	California Highway Patrol (CHP)
Certificate of Closure	City of Vernon

1.17 UTILITIES

Utilities comprised of electricity and natural gas associated with previous operations at the Site, have been disconnected. Remaining utilities include sanitary sewers, certain storm drains, and potable water available from adjacent hydrants.

1.18 SCHEDULE

Below Grade Work as described in these documents is anticipated to start in the field during April 2011, and, including Below Grade Demolition Work in the Phase IV area, must be completed by August 31, 2011.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

PART 4 – PAYMENT

There shall be no separate payment for CONTRACTOR or Subcontractor incidentals pursuant to implementation and compliance with the requirements of this Section. Full compensation for all CONTRACTOR implementation and compliance with this Section under this Contract shall be considered as included in the Contract unit or lump sum prices for the various items of the Contract to which the requirements of this Section relate.

END OF SECTION

SECTION 01275

MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 SCOPE

The Contract pay items described in this Section refer to the pay items listed on the Bid Form. They constitute all pay items for completion of the Work. No separate payment will be made for miscellaneous, temporary, or accessory Work such as, jobs signs, sanitary requirements, testing, safety devices, water supplies, power, watchmen, bonds, and insurance. Compensation for all such services, items and materials shall be included in the lump sum amounts and unit prices for the pay items listed on the Bid Form.

Payment includes full compensation for all required labor, product, tools, equipment, services and incidentals to complete the Work, including overhead and profit. Invoices submitted for payment shall include all applicable line items on the Bid Form originally submitted for the Work that have been completed to date.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to the Work of this Section.

B. Section 01290 – Schedule of Values

1.03 DEFECT ASSESSMENT AND NON-PAYMENT FOR REJECTED PRODUCTS

A. CONTRACTOR shall replace portions of the Work that do not conform to specified requirements as determined by ENGINEER.

B. If, in the opinion of ENGINEER, it is not practical to remove and replace the Work, ENGINEER will direct one of the following remedies:

1. The defective Work may remain, but the price for the associated task will be adjusted.
2. The defective Work will be partially repaired in accordance with ENGINEER'S instructions to the satisfaction of ENGINEER, and the price will be adjusted.

C. Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement by reason of failure of the CONTRACTOR to conform to the provisions of the Contract Documents.

3. Products placed beyond or outside the lines and levels of the required Work as indicated on the Drawings or established by the ENGINEER.

4. Products remaining on hand after completion of the Work.

5. Loading, hauling, and disposing of rejected products.

6. Products not completely unloaded from the transporting vehicle.

7. Work or material payment for which is contrary to the provisions of the Contract Documents.

1.04 FORMAT AND PREPARATION OF PAYMENT APPLICATIONS

A. CONTRACTOR shall submit typed applications for payment as described in the "Agreement Between Owner and Contractor For Construction Contract," (Agreement) and the "Standard General Conditions of the Construction Contract," (General Conditions).

B. CONTRACTOR shall execute application for payment by signature of authorized officer.

C. CONTRACTOR shall use line items from the approved Bid Form (Unit Price Schedule). Provide dollar value in each column for each line item for portion of Work performed.

D. CONTRACTOR shall list each authorized Contract Change as an extension on a continuation sheet, listing the Contract Change number and dollar amount as referenced against original item of Work.

1.05 SUBMITTAL PROCEDURES AND SUBSTANTIATING INFORMATION

A. CONTRACTOR shall submit one electronic copy and one hard copy of each Application for Payment to ENGINEER.

B. Payment Period: Submit Application for Payment at intervals in accordance with the Contract Documents.

C. Application for Payment shall be accompanied with any additional administrative submittals required by these Contract Documents.

D. Progress Reports shall be submitted with each Application for Payment that details the activities at the Site. ENGINEER will provide CONTRACTOR the format of the Progress Report prior to initiating any field activities. The proposed Progress Report shall detail work completed within each phase area, and shall segregate specific work completed as PCB or Non-PCB related. The Progress Report shall be reviewed and approved by OWNER prior to the submittal of any Application for Payment. Progress

Reports shall be generated by CONTRACTOR and submitted to ENGINEER on a weekly basis.

E. When OWNER or ENGINEER requires substantiating information, CONTRACTOR shall submit data justifying dollar amounts in question.

F. CONTRACTOR shall provide one copy of data with cover letter for each copy of submittal and show Application for Payment number and date, and line item by number and description.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 MEASUREMENT FOR PAYMENT

Weights will be determined by certified weight certificates from source/disposal facilities of each truck that enters/leaves the Site. CONTRACTOR shall be responsible for promptly submitting all weight certificates to ENGINEER. CONTRACTOR is responsible for collecting and providing all weight certificates and TSDF-signed copies of hazardous waste manifests to the ENGINEER. OWNER will not pay for wastes for which a valid weight ticket or TSDF-signed manifest copy is not received.

Weighing Equipment scales for the weighing of natural, manufactured or processed demolition and construction materials which are required to be proportioned or measured or paid for by weight, shall be furnished, erected, and maintained by the CONTRACTOR, or be certified, permanently installed commercial scales. CONTRACTOR Weighing Equipment scale shall conform with the California Code of Regulations, Title 4, Division 9, Section 2.21 for Belt Conveyor Scale Systems.

In the event CONTRACTOR elects to ship waste, debris or salvage material by rail, which disposal has been bid on a unit price basis, by weight, a Weigh Ticket from a public, certified railroad scale maintained by the carrier railroad shall be adequate measurement and proof of weight for purposes of payment.

Volume measurements for soil excavation shall be measured by the cubic yard (CY) as calculated in the stockpile location. In computing volumes of excavation the method used will be the average end-area method, or as stated in the appropriate Sections of the specifications.

Square footage of pavements, square footage of exposed face of shoring or bracing for additional excavation support, surface area in acres and linear feet of piping or other features demolished or decommissioned shall be determined by CONTRACTOR'S and ENGINEER'S joint measurement.

Items of Work for which payment is made by "Lump Sum" will be measured as a complete unit. Partial payment, if made, will be made in accordance with the ENGINEER-approved Schedule of Values described in Section 01290 – Schedule of Values.

PART 4 – PAYMENT

There shall be no separate payment for CONTRACTOR or Subcontractor incidentals pursuant to implementation and compliance with the requirements of this Section. Full compensation for all CONTRACTOR implementation and compliance with this Section under this Contract shall be considered as included in the Contract unit or lump sum prices for the various items of the Contract to which the requirements of the Measurement and Payment Section relate.

END OF SECTION

SECTION 01290

SCHEDULE OF VALUES

PART 1 – GENERAL

1.01 SCOPE

CONTRACTOR shall submit a Schedule of Values for approval by ENGINEER.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General Conditions apply to the Work of this Section.

1.03 SUBMITTALS

A. Schedule of Values: CONTRACTOR shall submit a Schedule of Values to ENGINEER as soon as practicable, and in no event later than 15 calendar days after receiving the Notice to Proceed, or at least 10 calendar days prior to submitting the first application for payment, whichever is sooner. The Schedule of Values shall meet the following requirements:

Content:

1. The Schedule of Values shall provide a detailed breakdown of the Work task and subsequent proposed billing for Bid Items provided in the Bid Form and consistent with Work phasing as presented in CONTRACTOR'S schedule and in the Contract Documents. The sum of costs for line item components of each Bid Item shall equal the Bid Item amount.

2. The value of each major completed item of Work and each subcontracted item of Work shall be listed by CONTRACTOR as a separate line item. All total values are to be rounded to the nearest whole dollar.

3. For each line item which has an installed or completed value of more than $10,000 break down costs to list major products of components including labor, equipment and materials.

4. Subcontractor schedules of values must also be submitted as applicable.

5. The sum of values listed, based on "primary" unit prices extended, and "lump sum" prices, shall equal the total lump sum price for the Bid Item. The sum of the Bid Item prices shall equal the Contract sum.

Substantiating Data:

1. When requested by OWNER, CONTRACTOR shall submit data justifying the individual Schedule of Values line item amounts in question.

Unit Rates:

2. When requested by OWNER, CONTRACTOR shall submit data justifying the individual Schedule of Values line item amounts in question.

3. CONTRACTOR shall submit hourly rates for laborers and operated and maintained equipment to be used when performing Work that is beyond the scope of these specifications upon written authorization by OWNER or ENGINEER.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

PART 4 – PAYMENT

Schedule of Values will not be measured separately. There shall be no separate payment for CONTRACTOR or Subcontractor incidentals pursuant to implementation and compliance with the requirements of this Section. Full compensation for all CONTRACTOR implementation and compliance with this Section under this Contract shall be considered as included in the Contract unit or lump sum prices for the various items of the Contract to which the requirements of the Schedule of Values Section relate.

END OF SECTION

SECTION 01330

SUBMITTALS AND PROCEDURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

This Section provides a list of Submittals required under this Contract. This Section also provides a schedule for CONTRACTOR'S submittal of these documents to ENGINEER.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General Conditions and the General Requirements apply to the Work of this Section.

B. Section 01290 – Schedule of Values

C. Section 01502 – Storm Water Management

D. Section 01550 – Traffic Control

E. Section 01900 – Health and Safety Requirements

F. Section 02114 – Soil and Waste Stockpiling

G. Section 02120 – Off-Site Transportation and Disposal

H. Section 02260 – Excavation Support and Protection

1.03 SUBMITTAL PROCEDURES

A. Within 15 calendar days of the date of commencement as stated in the Notice to Proceed, CONTRACTOR shall prepare and submit all documents as required in this Section. These documents include, but are not limited to: CONTRACTOR plans, CPM progress schedule, Schedule of Values, product information, shop drawings, dimensional data, manufacturer's instructions, and proposed off-Site disposal facilities.

B. For each submittal, CONTRACTOR shall state the project name, Subcontractor or supplier; clearly reference relevant and pertinent specification Section number, Construction Drawing and detail number(s), as appropriate.

C. CONTRACTOR shall schedule Submittals to expedite the project, and submit three copies to the ENGINEER, and one copy to the OWNER. CONTRACTOR shall also coordinate submission of related items.

D. ENGINEER will review CONTRACTOR Submittals and provide written comments to CONTRACTOR within 7 calendar days.

E. CONTRACTOR shall revise and resubmit Submittals within 5 calendar days, as required by ENGINEER or OWNER review, and identify all changes made since previous submittal.

F. CONTRACTOR will not be allowed to mobilize and begin actual fieldwork until all applicable Submittals have been received, reviewed and or accepted by ENGINEER. Except where otherwise approved, no demolition or remediation is to take place without a directive from both the City of Vernon Health & Environmental Control (H&EC) and the Department of Toxic Substances Control (DTSC). No demolition or remediation is to take place in PCB-impacted areas without approval from US EPA, or as directed by ENGINEER. ENGINEER may withhold CONTRACTOR invoice approval until all CONTRACTOR Submittals are complete.

G. CONTRACTOR shall distribute copies of reviewed and accepted Submittals to concerned parties and instruct parties to promptly report any inability to comply with provision.

1.04 REQUIRED SUBMITTALS

A. CONTRACTOR shall prepare the following items and submit them to ENGINEER for review or acceptance:

1. Construction CPM Progress Schedule (see Part 1.05 of this Section)
2. Proposed Product List (see Part 1.06 of this Section)
3. Proposed Materials List (see Part 1.07 of this Section)
4. Schedule of Values (see Section 01290 – Schedule of Values)
5. A Construction Plan within a three-ring binder that includes specific Sections, components or attachments that address the following Work-related issues:
   a. Work Plan that describes in text format the CONTRACTOR'S methods and means for executing each phase, general Work sequencing, and major components of Work
   b. A Site-specific Health and Safety Plan (see Section 01900 – Health and Safety Requirements)
   c. A Stormwater Pollution Prevention Plan (SWPPP) (see Section 01502 - Storm Water Management)

d. Decontamination Plan (See Section 01500 – Temporary Facilities and Site Controls)

e. Excavation Protection Plan (see Section 02260 – Excavation Support and Protection)

f. Traffic Control Plan (see Section 01550 – Traffic Control)

g. Soil Loading and Disposal Plan (see Section 02120 – Offsite Transportation and Disposal)

6. A list of all permits and licenses CONTRACTOR shall obtain indicating the agency required to grant the permit and the expected date of submittal for the permit application and required date for receipt of the executed permit.

B. Additional Submittals as required in the Contract Documents.

1.05 CONSTRUCTION CPM PROGRESS SCHEDULE

A. CONTRACTOR shall submit initial Critical Path Method (CPM) progress schedule in accordance with Part 1.04 of this Section. The Progress schedule shall be a bar graph (Gantt chart) with linked tasks and a clearly indicated critical path.

B. CONTRACTOR shall revise and resubmit the progress schedule to ENGINEER on a bi-weekly basis, and as required by ENGINEER.

C. The progress schedule shall show the proposed order of Work with a complete sequence of construction by activity, identifying Work of separate phases/stages, and other logically grouped activities. Progress schedule shall include beginning and completion dates for salient Work features and other milestones, predecessor(s) for each item, and the duration of each item with percent complete.

D. The progress schedule shall identify permits and approval that are the responsibility of the CONTRACTOR.

E. The progress schedule shall clearly indicate items or tasks that require OWNER or ENGINEER responses or input, or any other Work to be performed by OWNER or ENGINEER, necessary for CONTRACTOR to maintain schedule.

F. CONTRACTOR shall consider normal calendar year, holidays, weather delays, long lead items, review times, project phasing, project Site conditions and geometry, and space availability in preparing the progress schedule.

G. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates.

1.06 PROPOSED PRODUCTS LIST

A. CONTRACTOR shall submit a complete list of major products proposed for use including health and safety related personal protective equipment, air monitoring equipment, stormwater control products, geotextile fabrics, polyethylene sheeting or tarps for covering stockpiles, dust control products or related equipment, and all products that will be utilized for traffic control and Site security with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.07 PROPOSED MATERIALS LIST

CONTRACTOR shall submit complete list of materials proposed for use, including stormwater control materials, import granular fill materials with name and address of supplier, material specification sheet, and reference standards.

1.08 PRODUCT DATA

A. Submit two copies to be retained by ENGINEER.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data shall provide information unique to this Work.

C. After review, distribute in accordance with Part 1.03 above.

1.09 MANUFACTURER'S INSTRUCTIONS

A. CONTRACTOR shall submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for product data.

B. Any conflicts between manufacturers' instructions and Contract Documents shall be identified by CONTRACTOR.

1.10 MANIFESTS AND DISPOSAL OF HAZARDOUS AND NON-HARZARDOUS MATERIAL

CONTRACTOR shall submit copies of all manifests and records for disposal of any hazardous and non-hazardous materials in accordance with Section 02120 - Off-Site Transportation and Disposal.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

PART 4 – PAYMENT

Submittals and Procedures will not be measured separately. Full compensation for all CONTRACTOR implementation and compliance with this Section shall be considered incidental and included in the Contract lump sum price for Mobilization and Demobilization.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND SITE CONTROLS

PART 1 – GENERAL

1.01 SCOPE

This Section describes temporary facilities and controls that shall be provided by CONTRACTOR during performance of the Work.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the Agreement and General Conditions apply to the Work of this Section.

B. Section 01330 – Submittals and Procedures

C. Section 01502 – Storm Water Management

D. Section 01550 – Traffic Controls

E. Section 01900 – Health and Safety Requirements

1.03 SUBMITTALS

A. In accordance with Section 01330 – Submittals and Procedures.

B. CONTRACTOR shall submit to ENGINEER and OWNER, within the Construction Work Plan (Section 01330), the sequence of this Work, describing how equipment, vehicles, and personnel decontamination procedures will be implemented. Include design to contain and collect equipment washdown water, cleaners, and solvents. Personnel decontamination procedures shall also be outlined in the CONTRACTOR Health and Safety Plan (HASP).

1.04 ACCESS AND DRAINAGE

A. CONTRACTOR shall keep all natural drainage and water courses unobstructed or provide equal courses effectively placed, and prevent accumulations of surface water. CONTRACTOR shall construct grade and stabilize access roads, and provide temporary mobilization, parking, and storage areas for its use during construction within the areas shown on the Drawings or as approved by OWNER.

B. CONTRACTOR shall provide water management in accordance with Section 01502 – Storm Water Management.

C. CONTRACTOR shall maintain Site access, parking, and storage areas in stable and smooth condition throughout the duration of the Work. Traffic control measures shall be provided in accordance with Section 1550 – Traffic Controls.

1.05 TEMPORARY SANITARY FACILITES

A. CONTRACTOR shall furnish and maintain the necessary temporary self-contained sanitary facilities in accordance with all applicable regulations. CONTRACTOR shall not locate any temporary self-contained sanitary facilities within 200 feet of the eastern property boundary. The use of these facilities shall be available for use by CONTRACTOR'S employees as well as ENGINEER'S representatives and other project personnel on the Site.

B. CONTRACTOR shall furnish and maintain hand washing facilities for all Site personnel for the duration of the Work. Hand washing facilities shall be provided with running water.

1.06 CONTRACTOR STORAGE AREA

A storage area will be designated by OWNER or ENGINEER on the project Site for use by CONTRACTOR for storage of materials, tools, equipment, office, and other items necessary for construction. The exact limits of the storage area will be designated in the field by ENGINEER. CONTRACTOR shall be fully responsible for the preparation of this area, its maintenance, and its security, including fencing, watchmen, or other means of security. Under no circumstances will OWNER or ENGINEER be responsible for the security of any property belonging to CONTRACTOR, its Subcontractors, or any of its Work forces.

1.07 STAGING AREAS, STORAGE AND FIELD OFFICES

CONTRACTOR may, during the course of this project, stage construction, storage materials, or erect a temporary field office only within the CONTRACTOR'S Staging Area or as otherwise approved by ENGINEER.

1.08 DECONTAMINATION AND CARE OF WATER

A. CONTRACTOR shall furnish all labor, materials, supplies and equipment necessary for decontamination of equipment and for collection and temporary storage of decontamination washdown water, cleaners, and solvents generated during decontamination procedures.

B. All water used by CONTRACTOR during the project shall be obtained by CONTRACTOR from fire hydrants located within or near the Limits of Work shown on the Drawings. CONTRACTOR shall be responsible for obtaining prior written approval from OWNER and/or adjacent landowners as necessary, and for paying all fees related to fire hydrant connections and water usage during the project.

C. CONTRACTOR shall follow and implement the decontamination specifications outlined in this, and related, Sections and the CONTRACTOR'S Construction Plan and HASP, including those defined for PCBs in 40 CFR 761 Subpart S.

1.09 EQUIPMENT AND PERSONNEL DECONTAMINATION

A. CONTRACTOR shall establish decontamination area(s) for decontamination of all equipment and vehicles which contact Site soils and concrete surfaces. CONTRACTOR shall establish a separate decontamination facility for equipment a vehicles which contact PCB containing materials. CONTRACTOR shall insure that any equipment, vehicles, and personnel that have been in contact with Site soils and concrete surfaces are properly decontaminated, before leaving the Work area. CONTRACTOR shall identify decontamination areas and procedures for personnel and equipment decontamination in their Construction Plan.

B. CONTRACTOR may use brushing, vacuuming, steam cleaning, pressure washing, or equivalent methods for decontaminating vehicles and equipment. CONTRACTOR shall follow double wash/rinse methods for decontaminating all vehicles and equipment which come into contact with PCB containing materials. Steam cleaning may be required by ENGINEER, depending on the equipment condition.

C. CONTRACTOR shall pay all costs related to decontamination of CONTRACTOR'S equipment including disassembly, removal and off-Site disposal of the decontamination pad.

D. CONTRACTOR shall obtain all wash water needed for decontamination of equipment and personnel from a potable water source. Cleaners and solvents needed for decontamination of equipment and vehicles which have come into contact with PCB containing surfaces shall be provided at the sole expense of the CONTRACTOR. Disposal of decontamination water shall be performed at CONTRACTOR'S expense.

E. CONTRACTOR shall perform decontamination in a manner that meets the requirements of Section 01502 – Storm Water Management, Section 01900 – Health and Safety Procedures, and CONTRACTOR'S HASP and Construction Plan.

1.10 PROGRESS CLEANING AND DISPOSAL OF EXCESS SOLID WASTE

CONTRACTOR shall maintain Site in clean and orderly condition free of waste materials, debris, and rubbish. CONTRACTOR shall not locate any solid waste containers or bins within 200 feet of the eastern property boundary. CONTRACTOR shall collect, transport, and dispose of all collected solid wastes generated from their operations in accordance with applicable federal and state of California Solid Waste Disposal regulations at their own expense.

1.11 TEMPORARY ELECTRICAL POWER

CONTRACTOR is responsible to provide temporary power for their purposes. CONTRACTOR shall coordinate and arrange with local power company to provide the necessary power supply, or alternatively, provide for its own power using portable generators as required to complete the Work. CONTRACTOR shall be responsible for all temporary power costs.

1.12 TEMPORARY TELEPHONE SERVICE

CONTRACTOR is responsible to provide the necessary telephone services for CONTRACTOR purposes at no cost to OWNER or ENGINEER.

1.13 TEMPORARY FIELD OFFICES AND SHEDS

CONTRACTOR is responsible to provide the necessary temporary office and storage sheds for CONTRACTOR'S use for the duration of the project.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

PART 4 – PAYMENT

Temporary Facilities and Controls will not be measured separately. Full compensation for all CONTRACTOR implementation and compliance with this Section shall be considered incidental and included in the Contract lump sum price for Mobilization and Demobilization.

END OF SECTION

SECTION 01501

DUST CONTROL

PART 1 – GENERAL

1.01 DEFINITIONS

Dust shall mean airborne particulates of silica or fugitive dust that are associated with or resulting from CONTRACTOR'S activities. Of particular concern, includes but is not limited to, dust associated with CONTRACTOR'S demolition and crushing activities, excavation, backfilling and loading activities, truck traffic onto and off of the Site, and ambient wind traversing active work areas or excavated soil or open excavations.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General Conditions and the General Requirements apply to the Work of this Section.

B. Section 01330 – Submittals and Procedures

C. Section 01502 – Stormwater Management

D. Section 02114 - Soil and Waste Stockpiling

1.03 MINIMUM REQUIREMENTS

This Section includes specifications for CONTRACTOR'S responsibility to manage fugitive and silica dust and implementation of odor controls when applicable or as directed by ENGINEER. CONTRACTOR is responsible to comply with all local, regional, state, and federal requirements and regulations related to control of fugitive and silica dust and on Site odors.

To prevent the formation of dust, CONTRACTOR, at a minimum, shall be required to:

A. Furnish all labor, materials, facilities, equipment, services, employee training and testing, and agreements necessary to perform the Work required for fugitive dust and potential silica-generating construction dust control activities in accordance with these specifications, Health and Safety Plan, and the latest regulations and SCAQMD requirements. Whenever there is a conflict or overlap of the above references, the most stringent provisions are applicable.

B. In all cases where potential silica dust or chemical or biological odor exposures may occur, the CONTRACTOR shall use any and all feasible engineering and work practice controls to reduce and maintain employee exposure levels to or below the Permissible Exposure Level (PEL). It shall be assumed that the workers generating the silica dust or odors are exposed above the PEL until the CONTRACTOR air monitoring demonstrates the levels are below the PEL through personal sampling.

C. If visible fugitive dust emissions or respirable crystalline silica dust concentrations exceed 0.05 milligrams per cubic meter (mg/m3) beyond the perimeter of the work area, CONTRACTOR shall immediately stop work. CONTRACTOR shall perform all necessary corrective actions to eliminate visible dust and reduce respirable crystalline silica concentrations to less than 0.05 mg/m3 before resuming work.

D. Keep vehicle speeds on the property below 5 miles per hour.

E. Mist or spray water, excluding PCB-impacted soil and concrete areas, while performing any dust or odor generating activities. Water used for dust or odor suppression shall be potable water, or other acceptable water sources as defined in Section 01502 – Stormwater Management.

F. CONTRACTOR shall not use decontamination wash water for dust or odor control measures unless water has been treated to remove any Site COPCs that may be present.

G. Control excavation and concrete removal activities to minimize dust or odor generation.

H. Keep the drop heights to a minimum, while handling materials or loading transportation vehicles.

I. Cover soil stockpiles as specificed in Section 02114 - Soil and Waste Stockpiling.

J. Have a water supply available continuously.

K. Under no circumstances shall water be used to control dust and odors within PCB-impacted soil and concrete areas of the Site.Within these areas, CONTRACTOR shall use only ENGINEER-approved dust and odor control methods and means. CONTRACTOR shall submit to ENGINEER proposed methods and means for dust and odor control within PCB-impacted areas in CONTRACTOR's Work Plan.

1.04 SUBMITTALS

Provide description of proposed work practices for Dust Control in the CONTRACTOR Work Plan. Provide safety and monitoring measures in the Site-Specific Health and Safety Plan. Submit to Engineer for review and acceptance in accordance with Section 01330.

1.05 CONTINGENCY REQUIREMENTS

If visible dust or noticible odors are observed by CONTRACTOR, ENGINEER, OWNER, or regulatory agencies, CONTRACTOR shall perform the following:

A. Increase the magnitude of dust or odor control measures.

B. Increase the frequency of implementation of dust or odor control measures.

C. Decrease the rate of work production that is responsible for the dust or odor generating activities.

These contingency measures shall be performed at no additional cost to OWNER and CONTRACTOR shall include appropriate contingency funds in CONTRACTOR'S bid to cover such contingency measures.

1.06 EXCESSIVE WATERING

Except as required by ENGINEER, CONTRACTOR shall not employ dust or odor control methods which result in ponding, or surface erosion.

1.07 CONTRACTOR'S RESPONSIBILITY

Effective control of dust and odors is of paramount importance for protection of workers on the Site, for protection of the public, and for compliance with Laws and Regulations. During the performance of all Work, CONTRACTOR shall employ conscientious and effective means of dust and odor control. CONTRACTOR shall assume responsibility for all damages, delays, government-imposed penalties or fines, and claims which result from CONTRACTOR'S negligent dust and odor control practices. ENGINEER will stop Work at any time if CONTRACTOR dust and/or odor control methods are deemed inadequate or in-effective by ENGINEER, OWNER, or regulatory agencies. Any costs associated with the stoppage of Work due to inadequate or in-effective dust and/or odor control measures shall be the sole expense of CONTRACTOR.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 WET METHOD

A. Use "wet" systems that eliminate or reduce dust generated by CONTRACTOR'S activities.

B. Apply adequate water during concrete crushing and removal and stockpile management so to prevent visible dust emissions from leaving the Site boundary.

PART 4 – PAYMENT

Dust Control will not be measured separately. There shall be no separate payment for CONTRACTOR or Subcontractor incidentals pursuant to implementation and compliance with the requirements of this Section. Full compensation for all CONTRACTOR implementation and compliance with this Section under this Contract shall be considered as included in the Contract unit or lump sum prices for the various items of the Contract to which the requirements of this Section relate.

END OF SECTION

SECTION 01502

STORM WATER MANAGEMENT

PART 1 – GENERAL

1.01 SCOPE

Work under this Section includes preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) prepared by the CONTRACTOR. CONTRACTOR shall be responsible for the management and control of all storm water, rainfall, potable water discharges, and Contact Water at the Site during the performance of Below Grade Demolition and Soil Excavation Work. The CONTRACTOR'S SWPPP shall be implemented before, during, and after precipitation events and provide for post-construction storm water pollution controls following completion of Work. CONTRACTOR shall assume responsibility for all notifications, inspections, sampling, cleanup, damages, delays, government-imposed penalties or fines, and claims which result from CONTRACTOR'S non-compliance with their SWPPP, or failure to control storm water, spills, releases, or contact water.

1.02 RELATED REQUIREMENTS

A. Section 01330 – Submittals

1.03 DEFINITIONS

Contact Water: Storm water or other potable water supplies that contact soil, slabs or surface pavements known to contain COPCs, and in turn become impacted with COPCs.

Spill or Release: Uncontrolled or unanticipated release of chemicals (liquid or solid), fluids, fuels, oils, or other hazardous or impacted materials, that cannot legally be discharged to the ground surface.

Waters of the State: According to California Water Code §13050(e), "Waters of the State" means any surface water or groundwater, including saline waters, within the boundaries of the state.

Storm Water Management: Structural and non-structural measures provided by CONTRACTOR before, during, and after a rainfall event to minimize rainfall runoff from the Site, prevent on-Site sediment from being carried off-Site, and limit pollutant load to rainfall runoff.

Best Management Practices (BMPs): Includes schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent, eliminate, or reduce the pollution of waters of the receiving waters.

1.04 STORM WATER POLLUTION PREVENTION PLAN

CONTRACTOR shall prepare a Site-specific Storm Water Pollution Prevention Plan (SWPPP) for this project and submit the SWPPP to ENGINEER and the City of Vernon for review and approval in accordance with the Contract Documents. The SWPPP shall describe Best Management Practices (BMPs) that shall be established and maintained by CONTRACTOR during the Work in accordance with City of Vernon requirements, State Water Resources Control Board Storm Water Program 2009-0009-DWQ Construction General Permit (GCP) as applicable (2009-0009-DWQ becomes effective beginning July 1, 2010), California Regional Water Quality Control Board (Los Angeles Region), and Storm Water Pollution Prevention Plan Requirements for Construction Projects.

The CONTRACTOR shall submit a Notice of Intent to obtain coverage under the Construction NPDES Storm Water General Permit and prepare the SWPPP in compliance with the General Permit. The CONTRACTOR is responsible for providing qualified persons for the implementation of monitoring and verifying compliance with the SWPPP and the General Permit. The CONTRACTOR shall maintain a copy of the SWPPP and a copy of the CONTRACTOR's training, monitoring, and maintenance records on the Site at all times.

1.05 SPILLS

In the event of a spill in violation of California Fish and Game Code Section 5650, or release of a hazardous substance (as designated in 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), CONTRACTOR shall notify the OWNER immediately. If the spill exceeds the reporting threshold, CONTRACTOR shall follow the pre-established procedures for immediate reporting to the appropriate regulatory agencies. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Clean-up shall be in accordance with applicable federal, state, and local regulations. Additional sampling and testing may be required to verify spills have been cleaned up. Spill clean-up and testing shall be done at the sole expense of the CONTRACTOR.

1.06 SPILL RESPONSE MATERIALS

CONTRACTOR shall provide and maintain on-Site spill response materials including, but not limited to, containers, adsorbent, shovels, and personal protective equipment. Spill response materials shall be available at all times, in close proximity, and at sufficient quantities to handle hazardous materials/wastes that are being handled, stored, or transported. Spill response materials shall be compatible with the type of material being handled.

1.07 PROTECTION OF WATER RESOURCES

A. CONTRACTOR shall control the disposal and use of chemicals, petroleum products and foreign or hazardous materials, both on and off-Site and shall comply with applicable federal, state, county and municipal laws concerning pollution of soil, groundwater, rivers, and streams. Special measures shall be taken to prevent chemicals, petroleum products, construction materials, foreign substances, or hazardous materials from entering soil, groundwater, or Waters of the State.

Water used in on-Site material processing, dust and odor control, foundation and concrete clean-up, and other waste waters shall not be allowed to enter Waters of the State.

1.08 EROSION CONTROL

A. Surface drainage from cuts and fills within the construction limits, whether or not completed, shall be graded to control erosion within limits defined in the SWPPP.

B. Temporary control measures shall be provided and maintained by CONTRACTOR using BMPs described in the SWPPP.

C. The area of bare soil exposed at any one time by construction operations shall be held to a minimum.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 STORM WATER POLLUTION CONTROLS DURING SITE WORK

A. CONTRACTOR shall provide controls to prevent storm water runoff from contacting exposed soil containing COPCs on the Site. CONTRACTOR shall prevent Contact Water and sediment, especially sediment potentially containing Site COPCs, from migrating or flowing across the Site, cross-contaminating other areas of the Site, or leaving the Site.

B. Storm water that contacts Site soils not containing COPCs may be collected by CONTRACTOR and conveyed to other non-impacted parts of the Site for infiltration, or eventual discharge via active storm water drainage systems that are in compliance with CONTRACTOR'S SWPPP, or reused on Site for dust control purposes, at the discretion of the CONTRACTOR, so long as this activity does not violate City of Vernon requirements or any other requirements of the Contract Documents.

C. Contact Water shall be handled using the procedures described in the Specifications and pursuant to the CONTRACTOR'S SWPPP. Contact Water shall only be allowed to infiltrate those portions of the Site where the Contact Water originated, only to the extent that the area is already known to contain COPCs. CONTRACTOR shall be responsible for collection, treatment and/or disposal of Contact Water that is created due to CONTRACTOR'S failure to implement effective storm water or other water management practices. This determination shall be made by ENGINEER.

D. CONTRACTOR shall also provide controls to prevent storm water from flowing into, or accumulating in excavations, pits, or trenches constructed during the Work. CONTRACTOR shall be responsible for the removal, treatment (if required), and proper disposal of any rainwater or storm water that has accumulated in excavations, pits, or trenches prior to the pits being backfilled.

E. During performance of Below Grade Demolition and Soil Excavation Work, CONTRACTOR shall maintain Site areas, both paved and unpaved, to prevent ponding or accumulation of storm water, Contact Water, or other water at the Site, pursuant to the requirements of the City of Vernon.

F. If ENGINEER observes conditions that are not in compliance with the SWPPP or other applicable Laws and Regulations, ENGINEER will notify CONTRACTOR. CONTRACTOR shall provide a remedy immediately. If CONTRACTOR fails to take appropriate action, ENGINEER will provide a remedy and deduct the costs of the remedy from the amount due to CONTRACTOR.

G. After all Site Work is complete, the CONTRACTOR shall file a Notice of Termination for the General Permit. CONTRACTOR shall leave the Site such that there are storm water controls in place that prevent rainfall or storm water from ponding on-Site or from flowing off-Site in an uncontrolled manner.

3.02 GENERAL MONTHLY RAINFALL

Month	Average Monthly Rainfall (Inches)
January	3.18
February	3.44
March	2.45
April	1.05
May	0.26
June	0.06
July	0.01
August	0.06
September	0.28
October	0.44
November	1.3
December	2.37
Total	**14.92**

Source: Western Regional Climate Center

(1) Period of Record: 1/1/1914 – 12/31/2005

(2) Location: Los Angeles Civic Center

PART 4 – PAYMENT

Storm water Management will be measured as a lump sum. Payment will be calculated as a portion of the lump sum price for Storm Water Management as based on the unit price provided in the Bid Form, based on the percentage of Work completed as shown on the CONTRACTOR'S Schedule and Schedule of Values.

END OF SECTION

SECTION 01510

MOBILIZATION AND DEMOBILIZATION

PART 1 – GENERAL

1.01 SCOPE

A. Mobilization and Demobilization shall consist of all preparatory Work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to and from the project Site, necessary for the Work; for furnishing, erection, maintenance, and removal of construction signs and for all other Work and operations which must be performed, or costs incurred, not otherwise paid for under another bid item for this Contract.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General Conditions apply to the Work of this Section.

B. Section 01330 – Submittals and Procedures

C. Section 01500 – Temporary Facilities and Controls

D. Section 01900 – Health and Safety Requirements

PART 2 – PRODUCTS

2.01 MATERIALS

CONTRACTOR materials shall be suitable for their intended use and shall conform to applicable codes and standards. Manufacturer's requirements shall be strictly adhered to by CONTRACTOR. Recycled materials may be utilized after approval by ENGINEER or OWNER provided that they are sound and capable of performing their intended function. Recycled concrete and/or asphalt materials, imported from off-Site will not be allowed.

PART 3 – EXECUTION

3.01 MOBILIZATION

A. CONTRACTOR shall have submitted and obtained OWNER'S approval for all submittals required prior to the beginning of on-Site construction activities in accordance with Section 01330. Upon Mobilization, CONTRACTOR shall implement all requirements of Section 01500 prior to commencing with other Site Work.

3.02 EQUIPMENT AND TOOLS

A. CONTRACTOR shall deliver to the job-Site all construction equipment, tools, materials and supplies necessary for the performance of the Work.

B. CONTRACTOR shall perform safety inspections prior to use for all equipment and tools received on-Site.

3.03 LABOR FORCE

A. CONTRACTOR shall establish a Work force sufficient to commence and sustain the Work as required by the schedule. The Work force shall consist of competent and trained workers.

B. General Site workers (such as equipment operators, general laborers, and supervisory personnel) shall be required to have completed at a minimum 40-hour OSHA training in accordance with Section 01900-Health and Safety Requirements.

3.04 DEMOBILIZATION

A. CONTRACTOR shall remove all waste, including but not limited to, excess construction material, segregated waste, contaminated material, building debris, rubble, and foreign material. Haul and access roads shall be completely cleared of waste, dirt, and debris. Potentially contaminated equipment and materials shall be decontaminated prior to removal from Site.

B. CONTRACTOR shall disconnect and remove all temporary utilities installed by CONTRACTOR.

C. CONTRACTOR shall shut down, decontaminate, and remove all water storage facilities and decontamination areas.

PART 4 – PAYMENT

Mobilization and Demobilization will be measured as a lump sum and shall be full compensation for all Work described in this section. Payment will be based on the Contract lump sum bid price for Mobilization and demobilization, payable with 60 percent at mobilization and 40% at demobilization.

END OF SECTION

SECTION 01550

TRAFFIC CONTROL

PART 1 – GENERAL

1.01 SUMMARY

A. The Work under this Section includes furnishing all labor, materials, appliances, tools, equipment, transportation, services, and supervision required for designing, furnishing, installing, maintaining, and removing systems for control of traffic during execution of the Work.

1.02 REFERENCES

A. Section 01560 – Site Security

1.03 APPLICABLE STANDARDS AND SPECIFICATIONS

A. Regulatory requirements which govern the Work of this Section include, but may not be limited to, the following governing codes:

1. Applicable current State of California Vehicle Code Divisions 14.1 and 15.
2. Federal Highway Administration's (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) 2003 as amended by the MUTCD 2003 California Supplement. In this Section these two combined documents are referenced as "MUTCD."

1.04 SUBMITTALS

A. Prior to Mobilization to the Site, CONTRACTOR shall submit a Traffic Control Plan as a part of their Construction Work Plan. CONTRACTOR'S Traffic Control Plan shall be developed to address issues related to vehicle movement during transportation of equipment, soil, aggregates, supplies and other materials to and from the Site. The Traffic Control Plan shall identify primary ingress and egress routes at the Site, trucking haul routes to freeways from the Site and vice-versa, traffic controls and other requirements during off-Site shipments of soil and other materials, contingency measures for any actions to remediate spills in transit, and releases or accumulations on adjacent public right-of-ways.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All signs, channeling devices, traffic cones, vertical panels, barricades, signaling flags, temporary pavement markings, and other traffic control devices shall be in compliance with MUTCD requirements. Signs placed on the shoulder of streets in the vicinity of the Work Site shall be equipped with flashing lights and shall be constructed of Coroplast or an ENGINEER-approved soft material. All traffic control devices shall be inspected and maintained by CONTRACTOR.

B. All traffic barriers shall be in compliance with MUTCD requirements, including testing in accordance with the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features". The barriers shall be certified for use by the FHWA. CONTRACTOR shall provide test data or calculations certified by a licensed engineer currently registered in the State of California demonstrating that the barrier system will effectively prevent the intrusion of vehicles into excavation areas.

C. Traffic control devices used in construction and maintenance activities (i.e., signs, barricades or warning lights) which are placed in public right-of-way shall be marked or affixed with a sticker, clearly identifying the name, address and telephone number of the individual responsible for the control device.

D. Construction fences used to separate Work activities from pedestrians and motorists must be a minimum of six (6) feet tall and constructed of chain link material. See Section 01560 – Site Security for security fence requirements. CONTRACTOR shall install steady burn or flashing warning lights at least every 30 feet along the fencing that abuts roadways or the pedestrian and bicycle path.

PART 3 – EXECUTION

3.01 GENERAL

A. CONTRACTOR shall implement and perform Traffic Control during the Work in accordance with local, state, and federal regulations governing traffic control and consistent with Work described in the Traffic Control Plan.

B. Safety of the public and convenience of traffic shall be regarded as of prime importance. Unless otherwise directed, CONTRACTOR shall keep public streets open and shall provide a dust free, smooth and comfortable ride to traffic. It shall be responsibility of CONTRACTOR to ensure that traffic may safely bypass the construction sites. Flaggers shall assist traffic at all times when trucks are entering roadways. Two-way traffic shall be maintained on Fruitland and Boyle at all times.

C. CONTRACTOR shall plan and execute its operations in a manner that will cause a minimum interference with traffic. CONTRACTOR shall place and maintain in good condition, barriers where motorists or pedestrians are rerouted or blocked from using regular traffic lanes.

D. CONTRACTOR shall notify the OWNER at least five working days in advance of beginning any proposed Work with intention to close or partially block any street or any part thereof of any construction affecting free flow of traffic or closing /blocking any public sidewalk. CONTRACTOR shall plan and adequately provide barriers, barricades and warning devices.

E. All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

F. Prior to beginning Work, CONTRACTOR shall designate, in writing, a competent person who will be responsible and available on the project Site or in the immediate area to ensure compliance with Traffic Control. CONTRACTOR shall hold harmless OWNER, ENGINEER, their Agents, and employees from all suits, actions or claims, and from all liability and damages from any and all injuries and damages sustained by any person or property as a result of any neglect, omission, or misuse of Traffic Control Devices by CONTRACTOR. The decision to use a particular device at a particular location shall be the sole responsibility of CONTRACTOR.

G. CONTRACTOR shall restrict vehicular and pedestrian access to the Work areas in accordance with Section 01560 – Site Security.

H. CONTRACTOR shall schedule and stagger all trucks and material deliveries to minimize on-Site and off-Site congestion and to prevent accidents. Direct loading of trucks on public roadways is strictly prohibited.

I. CONTRACTOR is responsible for vehicular traffic of Subcontractors and vendors.

J. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, CONTRACTOR shall provide and maintain detours or other temporary measures to accommodate travel.

K. All barriers, barricades and obstructions in public right-of-ways shall be illuminated with warning lights from sunset to sunrise. Illumination shall meet the minimum requirements of MUTCD.

L. Material storage and conduct of the Work on, or along side, public streets shall cause a minimum obstruction and inconvenience of the traveling public.

M. CONTRACTOR'S Flaggers shall be required any time it is necessary for CONTRACTOR'S equipment to move into or across an open traffic lane, or at other such times as directed by ENGINEER. Flaggers shall be utilized to aid exit of hauling equipment from open traffic lanes to the Work area, and entry of hauling equipment from Work area to open traffic lanes. Flaggers shall be dressed and conduct operations in accordance with California Department of Transportation requirements. Flagging operations shall be the sole responsibility of CONTRACTOR.

N. If CONTRACTOR'S Traffic Controls are not in compliance with any of the above provisions as outlined in Section 01550, ENGINEER may elect to stop Work at

CONTRACTOR'S expense. CONTRACTOR may continue Work when Traffic Controls are approved by ENGINEER.

4.0 MEASUREMENT AND PAYMENT

Traffic Controls will not be measured separately. Full compensation for all CONTRACTOR implementation and compliance with this Section shall be considered incidental and included in the Contract lump sum price for Mobilization and Demobilization.

END OF SECTION

SECTION 01560

SITE SECURITY

PART 1 – GENERAL

1.01 SUMMARY

A. This Section describes Site security, and temporary security fencing that shall be provided by CONTRACTOR during performance of the Work.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 WORK SITE SECURITY

A. OWNER or ENGINEER are not responsible for any loss CONTRACTOR may incur due to theft or vandalism at the Site.

B. CONTRACTOR shall be responsible for Site security and shall install sturdy security fencing and gates at least 6 feet in height constructed of chain-link material equipped with a windscreen fabric to provide a physical and visual barrier around the Work Site as required for Site security. CONTRACTOR shall also maintain and protect existing property boundary fences, walls and windscreen fabric.

C. CONTRACTOR shall be responsible for barricades, signs, and other measures as necessary for protection and access control of all open pits and sumps, open excavation areas and stockpiled soil. CONTRACTOR shall be responsible for protecting all Work areas and open excavations from entry by unauthorized personnel or the unknowing public. In no case shall the degree of Site security be reduced by CONTRACTOR'S Work or failure to act.

D. CONTRACTOR shall be responsible for controlling access to the Site and other defined Work zone limits and boundaries for general public visitors, venders, CONTRACTOR and Subcontractor personnel and other unauthorized personnel. CONTRACTOR shall maintain a daily sign-in sheet for all Site Visitors. CONTRACTOR shall submit daily sign-in sheet to ENGINEER on a bi-weekly basis.

E. CONTRACTOR shall provide temporary installation of sturdy security fencing and gates at least 6 feet in height constructed of chain-link material that prevents entry by the public to active construction areas, open excavations, and stockpiled material. Security fencing along public roadways shall be installed such that it does not prevent excavation of soils adjacent to the roadway. Temporary fencing may be installed using portable bases for support. Portable bases shall secure the temporary fencing during windy conditions (up to 50 miles per hour). CONTRACTOR shall immediately repair security fencing that is blown down or damaged by CONTRACTOR or the public.

3.02 ON-SITE SECURITY PERSONNEL

A. At CONTRACTOR'S discretion, CONTRACTOR may provide its own security personnel. No additional payment will be made for such personnel.

B. CONTRACTOR shall ensure that any security personnel have been made aware of the Site hazards and provided with the training and medical examination requirements as required to perform the Work.

C. OWNER shall have the right of approval and rejection of the security personnel assigned to the Work Site at any time during the Work.

PART 4 – MEASUREMENT AND PAYMENT

A. Site Security will not be measured separately. Full compensation for all Work described in this Section shall be made as part of the lump sum price for Mobilization and Demobilization.

END OF SECTION

SECTION 01770

CONTRACT CLOSEOUT

PART 1 – GENERAL

1.01 SCOPE

Contract Closeout is defined to include general requirements near end of the Contract in preparation for final completion, final payment, normal termination of Contract, and similar actions evidencing completion of the Work.

1.02 SECTION INCLUDES

A. Prerequisites to Substantial Completion and Final Completion.

B. Testing.

C. Protecting installed construction.

D. Submittals.

E. Project Record Documents.

1.03 PREREQUISITES TO SUBSTANTIAL COMPLETION

A. Prior to requesting inspection for certification of Substantial Completion, for either entire project or phases or portions thereof, CONTRACTOR shall complete and submit the following, or evidence thereof, along with written request to ENGINEER for inspection:

1. A list of items to be completed or corrected after Substantial Completion, the value of each incomplete item, and reasons for incompletion of each.

2. Construction costs for completing including labor, material and all fixtures.

3. Final cleanup requirements for the Site including the removal of all surplus materials, discarded materials, and rubbish.

4. All warranties and guarantees.

5. Partial lien waivers for Work completed and for which CONTRACTOR has been paid.

B. Inspection Procedure: Upon receipt of CONTRACTOR'S request, ENGINEER and OWNER will either proceed with inspection or ENGINEER will advise CONTRACTOR of prerequisites not fulfilled. Following initial inspection, ENGINEER and OWNER will either prepare Certificate of Substantial Completion, or advise CONTRACTOR of Work which must be performed prior to issuance of certificate and repeat inspection when assured that Work has been substantially competed. Results of completed inspection will form a "punch-list" of activities to be completed by CONTRACTOR prior to final acceptance.

1.04 PREREQUISITES TO FINAL COMPLETION

A. Prior to requesting ENGINEER'S and OWNER'S final inspection for certification of final completion and final payment, as required by the General Conditions, CONTRACTOR shall complete and submit to ENGINEER the following and list known exceptions in request:

1. Final payment request with itemized invoice and backup invoices from equipment suppliers and final lien waivers and supporting documentation not previously submitted and accepted.

2. Updated final statement, accounting for final changes to Contract Sum.

3. Final copies of all weigh tickets, manifests, Bills of Lading and Disposal Log.

4. Copy of ENGINEER'S final punch-list of itemized Work to be completed or corrected, certifying that each item has been completed or otherwise resolved for acceptance.

5. Certification from CONTRACTOR'S liability insurance carrier that no claims for death, personal injury, or property damage have been filed or are reasonably anticipated in connection with CONTRACTOR'S Work on the Site.

B. Re-inspection Procedure: Upon receipt of CONTRACTOR'S notice that Work has been completed, including punch-list items resulting from earlier inspections and except incomplete items delayed because of acceptable circumstances, ENGINEER will re-inspect Work. Upon completion of re-inspection, ENGINEER will either prepare certificate of final acceptance or advise CONTRACTOR of Work not completed or obligations not fulfilled as required for final acceptance. If ENGINEER finds items during walk-through which have not been properly adjusted, reworked, or replaced as indicated on the ENGINEER'S punch list from the previous walk-through, CONTRACTOR shall be charged ENGINEER'S normal hourly billing rate and reasonable expenses for all subsequent walk-throughs.

1.05 TESTING

A. Reports shall be submitted to ENGINEER indicating observations and results of tests and indicating compliance or non-compliance with requirements of the bid package.

1.06 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.

1.07 SUBMITTALS

A. General: ENGINEER'S approval of the current status of Project Record Documents will be a prerequisite to ENGINEER'S approval of requests for project payment and request for final payment as defined in the Contract Documents.

B. Progress Submittals: Prior to submitting each request for progress payment, secure ENGINEER'S approval of Project Record Documents as currently maintained. ENGINEER will initial and date each drawing at the time of approval.

C. Final Submittal: Prior to execution of the semi-final payment, submit the final Project Record Documents to ENGINEER and secure their approval.

1.08 SURVEYING

A. All surveying shall be performed by a State of California Licensed Surveyor. Locations shall be surveyed to within 0.1 foot relative to the North American Datum of 1927 (NAD27), California State Coordinate System. Elevations shall be surveyed to within 0.01 foot relative to the 1988 North American Vertical Datum (NAVD88). Final Grading topographic survey Work shall have an accuracy of at least the 3rd order as defined by the Caltrans Survey Manual. The locations of any remaining portions of below grade structures surveyed as defined in Contract Documents shall be plotted and submitted to the ENGINEER in the form of an AutoCAD file (with Pen table) and a D-size (22-inch by 34-inch) hard copy drawing with company name and date of submittal clearly noted on the drawing.

1.09 PROJECT RECORD DOCUMENTS

Project Record Documents are to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modifications or designs to proceed without lengthy and expensive Site measurement, investigation and examination.

A Maintain on-Site one set of the following record documents; record actual revisions:

1. Drawings.
2. Specifications.
3. Addenda.

4. Change Orders and other modifications to the Drawings and Specifications.

5. Reviewed Shop Drawings, Product Data, and Samples.

6. Manufacturer's instruction for assembly, installation, and adjusting.

B Ensure entries are complete and accurate, enabling future reference by OWNER or ENGINEER.

C. Store Project Record Documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and modifications.

E. Record Drawings: Legibly mark each item to record actual construction including:

1. Record date and location of major Work as performed by Phases described in the Contract Documents.

2. Survey and document location, lateral extent and depth to the top or uppermost portion of any remaining subsurface structures left in place after completion of Below Grade Demolition, as specified in the Contract Documents. Include date of final Work of each demolition component by structure, i.e. structure demolition, structure perforation and backfilling, structure capping.

3. Survey and document location, lateral extent and depth to the top or uppermost portion of any remaining utilities and pipelines either grouted in place or capped at the property boundary after completion of Below Grade Demolition, as specified in the Contract Documents. Include pipe diameter and material of construction, type of utility, and date of final Work performed on each utility or pipeline noted in the drawing.

4. Record and document location, type and extent of any remaining active utilities after completion of Below Grade Demolition Work.

5. Record and survey boundaries of any remaining pavements, slabs, walls or other above ground structures.

6. Surveyed field dimensions of soil excavation areas. Include start and finish date for each excavation area as shown on the Drawings.

7. Backfill areas where crushed recycled aggregates were placed at finished thicknesses greater than three-feet.

8. Relevant details or other notes as applicable.

F. Submit Final Project Record Documents to ENGINEER as follows:

1. At completion of the Work, secure a review by ENGINEER of all recorded data. Make all required revisions.

2. Submit the completed total set of Project Record Documents to the ENGINEER as described in Paragraph 1.07. Participate in review meeting as required by ENGINEER, make all required changes in the Project Record Documents, and promptly deliver the final Project Record Documents to ENGINEER.

PRODUCTS

Not Used.

EXECUTION

Not Used.

PART 4 – PAYMENT

There shall be no separate payment for CONTRACTOR for implementation and compliance with the requirements of this Section. Full compensation for all CONTRACTOR implementation and compliance with this Section under the Contract shall be considered as included in the Contract lump sum price for Mobilization and Demobilization.

END OF SECTION

SECTION 01900

HEALTH AND SAFETY REQUIREMENTS

PART 1 – GENERAL

1.01 SCOPE

This Section outlines the health and safety requirements to be followed by the CONTRACTOR during the performance of the Work. It is anticipated that the CONTRACTOR will perform the majority of the Work utilizing Level D protection with the ability to upgrade to Level C. This section does not preclude the CONTRACTOR'S responsibility to conduct certain Work tasks in Level A or Level B as required.

These requirements are in addition to but do not supersede any federal, OSHA, state, Cal/OSHA, or local regulations. If a conflict occurs between these requirements and current regulations, the more stringent shall apply. These requirements are in accordance with and incorporate the current health and safety guidelines established in the Standard Operating Safety Guides, prepared by the EPA Office of Emergency and Remedial Response, Hazardous Response Support Division, September 1984, and the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, October 1985, and OSHA and Cal/OSHA standards for hazardous waste operations (29 Code of Federal Regulations (CFR) 1910.120 and 8 California Code of Regulations (CCR))

1.02 DEFINITIONS

A. CIH – Certified Industrial Hygienist – A trained specialist with at least 5 years experience in hazardous material processing and working knowledge of selection and use of personal protective equipment (PPE), air monitoring, regulations, and other health and safety issues.

B. SSO – Site Safety Officer – A trained specialist in health and safety with a minimum of 3 years experience and working knowledge of the use of PPE, field monitoring equipment, regulations, and hazard identification.

1.03 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General Conditions apply to the Work of this Section.

B. Section 01330 – Submittals and Procedures

C. Section 01500 - Temporary Facilities and Site Controls

D. Section 01501 – Dust Control

E. Section 01900 – Health and Safety Requirements

F. Section 02120 – Off-Site Transportation and Disposal

1.04 SUBMITTALS

A. CONTRACTOR shall submit its Site Health and Safety Plan in accordance with Section 01330 - Submittals and Procedures.

B. CONTRACTOR shall submit OSHA 40-hour training certificates and current 8-hour update certificates for each worker that enters the Exclusion Zone and Contamination Reduction Zone areas and maintain a file of these certificates on-Site (see Paragraph 1.07).

C. Qualifications: The names and qualifications of the CONTRACTOR'S CIH and SSO.

1.05 HAZARDOUS MATERIALS HEALTH AND SAFETY

A. The project Site is a former aluminum casting facility. The facility historically handled various chemicals and regulated substances. The subgrade soil is impacted with volatile organic compounds (VOCs) consisting of chlorinated and non-chlorinated solvents such as trichloroethene (TCE), petroleum products, metals, and polychlorinated biphenyls (PCBs). The groundwater is impacted with chlorinated solvents. Localized concrete surfaces are impacted with PCBs as shown on the Drawings. The handling and management of PCB-containing materials shall comply with Toxic Substances Control Act (TSCA) regulations (40 CFR 761). The significant compounds of concern in soil include:

COPC	Maximum Concentration Detected in Soil	Units
PCB (Aroclor 1248)	2,000,000	µg/kg
Benzene	1600	µg/kg
Naphthalene	5400	µg/kg
1,2,4 Trimethylbenzene	37,000	µg/kg
1,3,5 Trimethylbenzene	9,400	µg/kg
TCE	3,800	µg/kg
PCE	260	µg/kg
Stoddard Solvent	890	mg/kg
Heavy Range TPH (C22-C44)	1217	mg/kg
Arsenic	16.00	mg/kg
Cadmium	5	mg/kg
Chromium (Total)	200	mg/kg

Lead	3,000	mg/kg

B. Prop 65 Notification: CONTRACTOR and CONTRACTOR'S personnel shall be notified that chemicals known to the State of California to cause cancer, birth defects, or reproductive harm are known to be present at the Site.

C. In addition to the guidelines referenced above, the following regulations and references apply to performance of the Work:

1. Hazardous Waste Operations and Emergency Response - 29 CFR 1910.120 and 8 CCR 5192
2. Occupational Safety and Health Administration (OSHA), Construction Industry Standards - 29 CFR 1926
3. Occupational Safety and Health Administration (OSHA), General Industry Standards - 29 CFR 1910
4. Cal/OSHA Standards – Title 8 CCR
5. HSE Performance Standards – Environment, E2 Air Quality Control, E5 Hazardous Materials and Contamination Control, E7 Non-Mineral Waste Management, Rio Tinto, December 2008
6. HSE Performance Standards – Health, B1 Particulate and Gas/Vapour Exposures, B2 Hearing Conservation, B4 Hazardous Substances, B6 Thermal Stress, B10 Occupational Exposure Limits, Rio Tinto, December 2008
7. HSE Performance Standards – Safety, C3 Vehicles and Driving, C5 Confined Spaces, C6 Cranes and Lifting Equipment, Rio Tinto, December 2008

1.06 CONTRACTOR'S RESPONSIBILITIES

A. CONTRACTOR is solely responsible for the health, safety, and protection of CONTRACTOR'S on-Site personnel or Subcontractors during the performance of the Work. CONTRACTOR shall perform the Work specified in these Contract Documents in accordance with the health and safety requirements specified herein, including the current edition of the Standard Operation Safety Guides and OSHA Guidance Manual, Rio Tinto HSE Performance Standards, and all federal, OSHA, state, and local health and safety regulations. It shall be the responsibility of the CONTRACTOR to be familiar with the required health and safety regulations in the performance of this Work.

B. CONTRACTOR shall prepare a Site-specific Health and Safety Plan in accordance with Laws and Regulations. CONTRACTOR'S Health and Safety Plan shall be prepared under the supervision of and be signed by a Certified Industrial Hygienist.

C. CONTRACTOR shall provide a Health and Safety Officer to implement, monitor, and enforce its Site Health and Site Safety Plan. The Health and Safety Officer shall have a sound working knowledge of federal and state occupational safety and health regulations and formal educational training in occupational safety and health.

D. The Health and Safety Officer may implement requirements in addition to those specified herein.

E. CONTRACTOR'S bid shall be based on use of specific levels of personal protection for various portions of the Work as described in the Contract Documents. It is anticipated that CONTRACTOR will perform the majority of the Work utilizing Level D protection with the ability to upgrade to Level C. Use of such levels in preparing the bid shall in no way influence the proper selection by CONTRACTOR of appropriate levels of worker protection in accordance with CONTRACTOR'S Site Health and Safety Plan based on actual Site conditions.

F. Should any unforeseen or Site-specific safety regulated factor, hazard, or condition become evident during the performance of the Work, CONTRACTOR shall take immediate and prudent action to establish and maintain safe working conditions and to safeguard Site personnel, the public and the environment. CONTRACTOR shall also immediately inform the ENGINEER of such a condition.

G. Personnel Requirements

1. Certified Industrial Hygienist (CIH)

a. Qualifications of the CIH include:

i. Minimum of five (5) years experience in hazardous material processing.

ii. Demonstrable experience in Personal Protective Equipment (PPE) selection and use, hazardous material identification and disposal procedures, air monitoring techniques, and Site control measures.

iii. Working knowledge of federal OSHA and state regulations.

iv. Completion of all required OSHA Training in accordance with 29 CFR 1910.120, including completion of forty (40)-hour supervisory training and eight (8)-hour annual update and completion of three (3) days on-Site training by a fully qualified instructor.

b. Responsibilities:

i. Responsible for certifying the CONTRACTOR'S HASP, any task specific HASPs, and all additions and/or modifications thereto.

ii. Required to be accessible to the CONTRACTOR'S SSO as necessary, to assist in the identification and evaluation of potential hazards and the development of appropriate procedures for addressing known or suspected conditions or activities that may pose routine occupational hazards or immediate danger to life or health of all personnel on-Site and the public.

c. Authority:

i. Suspend field activities if health and safety of any personnel on-Site or the public is endangered.

ii. Suspend individuals from field activities due to infractions of the HASP.

2. Site Safety Officer (SSO) – Qualifications of the SSO include:

a. Qualifications of the SSO include:

i. Completion of all required OSHA Training in accordance with 29 CFR 1910.120, including completion of forty (40)-hour supervisory training and eight (8)-hour annual update and completion of three (3) days on-Site training by a fully qualified instructor.

ii. Minimum of three (3) years of experience in hazardous substance/waste Site remediation or related Work.

iii. Current certification in first aid and cardiopulmonary resuscitation (CPR).

iv. Working knowledge of federal, state, and local occupational health and safety regulations.

v. Working knowledge of air monitoring techniques and the development of health and safety programs for personnel working in potentially hazardous or toxic environments.

b. Responsibilities:

i. Required to be on-Site on full-time basis when any Work is in progress.

ii. Responsible for the development, implementation, enforcement, and monitoring of the Health and Safety Program for the Project.

iii. Responsible for conducting the preconstruction indoctrination, pre-entry briefings, and other periodic training of all on-Site CONTRACTOR personnel with regard to contents of the HASP and other safety requirements to be observed during construction.

iv Responsible for performing air monitoring as required by the applicable regulations and the HASP.

v. SSO may have other project duties and not be solely dedicated to health and safety.

c. Authority:

i. Suspend field activities if health and safety of any on-Site personnel or the public is endangered.

ii. Suspend individuals from field activities due to infractions of the HASP.

3. Workers

a. Qualifications as applicable:

i. Asbestos is present in certain subsurface piping materials. Workers abating Asbestos Containing Materials (ACM) shall have appropriate California Asbestos Worker or Supervisory training.

ii. Lead may be present in dust and remaining painted surfaces. Workers coming into contact with lead-bearing materials shall have a minimum of 8-hour lead awareness training in accordance with Section 02120.

iii. Metals dust and PCB contamination may be present on concrete or slab surfaces of the former buildings. All workers at the Site shall be 40-hour trained in hazardous materials handling per OSHA requirements and in accordance with Section 01900.

iv. Fugitive and silica dust generation is expected on this project. Workers at the Site shall have the necessary training as required by regional or state regulations and in accordance with Section 01501.

1.07 WORK AREAS

A. The CONTRACTOR shall clearly lay out and identify Work areas or zones in its Site Health and Safety Plan and shall limit equipment, operations, and personnel in the areas as defined below:

1. Exclusion Zone: The exclusion zone (EZ) is the zone where contamination does or could occur. All people entering the exclusion zone shall wear prescribed levels of protection. An entry and exit check point shall be established at the periphery of the exclusion zone to regulate the flow of personnel and equipment into and out of the zone and to verify that the procedures established to enter and exit are followed.

2. Contamination Reduction Zone:

    a. Between the exclusion zone and the support zone is the contamination reduction zone (CRZ), which provides a transition between contamination and clean zones. The CRZ serves as a buffer to further reduce the probability of the clean or support zone becoming contaminated or being affected by other exiting hazards. It provides additional assurances that the physical transfer of contaminating substances on people, equipment, or in the air is limited through a combination of decontamination, distance between exclusion and support zones, air dilution, zone restrictions, and Work functions.

    b. At the boundary between the EZ and CRZ, decontamination station(s) shall be established, one for personnel and small equipment, and one for heavy equipment. Facilities shall be provided as specified to provide for adequate decontamination of personnel and equipment and to maintain the cleanliness of the contamination reduction zone.

3. Support Zone: This area is defined as being an area outside the zone of contamination. The support zone (SZ) shall be clearly delineated and shall be secured against active or passive contamination from the Work Site. The function of the area includes:

    a. An entry area for personnel, material, and equipment to the area of Work,

    b. An exit area for decontaminated personnel, materials, and equipment from the Work area,

        i. The housing of Site services; and

        ii. a storage area for clean safety and Work equipment.

1.08 PERSONNEL PROTECTION PROGRAM/SITE HEALTH AND SAFETY PLAN

A. CONTRACTOR shall establish and maintain a complete Health and Safety Program for all personnel working at the Site including personnel that are not CONTRACTOR'S employees or Subcontractors. CONTRACTOR shall prepare a Site-specific Health and Safety Plan, under the direction and approval of their CIH, that describes the Site and potential hazards and prescribes monitoring requirement, personal protection requirements and criteria for their selection, Work practices and limitations, and emergency response. CONTRACTOR shall submit Site-specific Health and Safety Plan to ENGINEER for review 15 calendar days prior to mobilization. CONTRACTOR will not be allowed to mobilize to the Site without ENGINEER'S acceptance of Site-specific Health and Safety Plan, including any requested or required modifications and any task-specific requirements and procedures developed for this project.

B. CONTRACTOR shall certify that all CONTRACTOR, Subcontractor, or service personnel entering the EZ or CRZ for the purpose of the Work, for health, safety, security, or administration purposes, for maintenance, or for any other Site-related function, have received safety training as defined in Paragraph (3) of 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response, Interim Final Rule," including supervisory personnel.

C. CONTRACTOR shall be responsible for and guarantee that personnel not successfully completing the required training are not permitted to enter the EZ or CRZ for any reason during Work activities.

D. CONTRACTOR shall provide and require that all previously trained CONTRACTOR, Subcontractor, or service personnel assigned to or entering the EZ and CRZ are capable of and familiar with the use of safety, health, respiratory, and protective equipment and with the safety and security procedures required for this operation.

E. All personnel utilizing respiratory protection equipment shall be fit tested and properly trained and experienced in their use. All respiratory protection equipment that is utilized shall be properly decontaminated and sanitized at the end of each Work day.

F. CONTRACTOR shall provide all on-Site personnel with appropriate personal safety equipment and protective clothing. CONTRACTOR shall ensure that all safety equipment and protective clothing is kept clean and well-maintained. All personal protective equipment shall be properly disposed of or decontaminated at the end of the Work day.

1.09 INITIAL ON-SITE TRAINING

A. CONTRACTOR shall provide Site-specific training to all personnel who will work on the Site, including personnel that are not CONTRACTOR'S employees or Subcontractors. This Site-specific training shall include, but not be limited to, all items listed below, including emergency procedures for chemical exposure or release, fire, or explosion, and personal injury:

1. Acute and chronic effects of any toxic chemicals identified at the Site.
2. Physical health hazards identified at the Site.
3. Personal hygiene.
4. Safety equipment and procedures required for personal protection.
5. Proper use and fitting of respirator protection equipment.
6. Work zones established at the Site.
7. Decontamination procedures.
8. Prohibitions in contaminated areas:
    a. Beards and long sideburns, if respiratory protection is anticipated or required.
    b. Eating, smoking, chewing.
    c. Working when ill.
    d. Working under the influence of alcohol or drugs.
9. Buddy system explained.
10. Emergency response.

1.10 EMERGENCY AND FIRST AID REQUIREMENTS

A. CONTRACTOR shall pre-arrange for emergency medical care services at a nearby medical facility and establish emergency routes. CONTRACTOR shall establish communications links with health and emergency services to inform them of any emergency situations that may arise.

B. In the event of any emergency associated with or resulting from Work at this Site, CONTRACTOR shall cease Work activity on the Site, as appropriate, per CONTRACTOR'S Site Health and Safety Plan. CONTRACTOR shall also take diligent action to remove or otherwise minimize the cause of the emergency, render full assistance to local authorities to remedy any impact on local residents or property, alert ENGINEER, and institute whatever measures might be necessary to prevent any repetition of the conditions or actions leading to or resulting in the emergency.

C. CONTRACTOR shall have at least one certified First Aid Technician on-Site at all times of Work. This person may perform other duties, but must be immediately available to render first aid when needed. Certification shall be current, kept on-Site, and consist of successful completion of an American Red Cross course in Multi-Media First Aid and Cardio-Pulmonary Resuscitation (CPR).

1.11 PERSONAL HYGIENE AND DECONTAMINATION

A. CONTRACTOR shall be responsible for, and ensure that all CONTRACTOR, Subcontractor, and service personnel performing or supervising remedial Work within the EZ or CRZ, or exposed or subject to exposure to hazardous chemical vapors, liquids, dusts, or contaminated solids, observe and adhere to the personal hygiene-related provisions of this Section, the EPA Standard Operating Safety Guides, and all federal and OSHA regulations and guidance.

B. CONTRACTOR, Subcontractor, and service personnel found to be consistently disregarding the personnel hygiene-related or health and safety provisions of this plan shall, at the request of the ENGINEER, be barred from the Site at no cost to OWNER or ENGINEER.

C. CONTRACTOR shall provide all personnel, materials, and equipment needed to support their health and safety program. Equipment shall include:

1. Suitable disposable outer wear, gloves, hard hats, and footwear on a daily basis for the use of all on-Site personnel including ENGINEER.

2. Appropriate NIOSH Certified respiratory protection equipment, if required, in sufficient quantities for all CONTRACTOR on-Site personnel.

3. Canisters, cartridges, spare parts, repair tools, hoses, connectors, and other respiratory protection support items as needed.

4. Contained storage and disposal for used outer wear.

5. Hand washing facilities.

6. A facility for changing into and out of and storing Work clothing, separate from street clothing, including separate facilities for women.

7. Sanitation facilities as specified in 29 CFR 1926.

8. A lunch and/or break area.

9. A smoking area well separated from the EZ and CRZ.

D. Used disposable outer wear shall not be reused, and when removed, shall be placed inside disposal containers provided for that purpose and managed in accordance with Section 02120 – Offsite Transportation and Disposal.

E. Smoking, chewing tobacco, eating, and drinking shall be prohibited in the EZ and CRZ.

F. Soiled disposable outer wear shall be removed prior to leaving the CRZ to enter the SZ, and prior to cleansing hands.

1.12 VEHICLE AND EQUIPMENT DECONTAMINATION

A. The CONTRACTOR'S Construction Plan shall state the locations of proposed CRZ areas and the procedures to be implemented for removing contaminants from personnel and equipment that contact sludge, waste, stabilized waste, COPC-impacted soil, concretewater, or other waste materials. CONTRACTOR'S decontamination procedures for surfaces that have contacted PCBs shall comply with the requirements set forth in 40 CFR 761 Subpart S. Additional requirements for equipment decontamination are provided in Section 01500 – Temporary Facilities and Controls.

B. CONTRACTOR shall submit with its Site Health and Safety Plan the proposed method for collecting and disposing of wash water and other decontamination fluids.

C. Personnel engaged in vehicle decontamination shall wear protective equipment including disposable clothing and respiratory protection as necessary.

1.13 WORK AREA AIR MONITORING

A. During the progress of the Work and as required by CONTRACTOR'S Site Health and Safety Plan, CONTRACTOR shall monitor the quality of the air in and around each active Work location on a regular periodic basis (continually when respiratory protection is worn) to determine the need for respiratory protection and/or an upgrade in personal protective equipment. Monitoring shall comply with the requirements of Paragraph (h) of 29 CFR 1910.120 and any other applicable requirements. Any departures from general background shall be entered in the monitoring and project logs.

B. CONTRACTOR shall maintain a log of the location, time, type, and value of each reading. Copies of daily log sheets shall be included in a daily report to the ENGINEER and shall be provided within 24 hours.

C. CONTRACTOR'S Site Health and Safety Plan shall indicate air monitoring readings or indications that will be used to initiate protective actions including, but not limited to, use of personal protective devices and Site evacuation. CONTRACTOR shall provide justification for such action levels in his Site Health and Safety Plan.

1.14 VEHICLE TRAFFIC

Reckless driving will not be allowed at the Site. Excessive speed and/or reckless driving may result in suspension or dismissal of the operator of the vehicle. All motor driven equipment using fuel shall have spark arrestors.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Personal Protective Equipment (PPE) and monitoring equipment shall conform with requirements set forth by federal and state regulations and the standards of the industry.

B. Respiratory Protection

1. Where exposures to respirable crystalline silica may exceed 0.1 mg/m^3 based on an 8-hour time-weighted average (TWA), workers shall be provided, as a minimum, with personally issued and marked respirators equipped with high efficiency particulate air (HEPA) filters approved by NIOSH (99.97% efficient) to be worn in the designated Work area. Sufficient filters shall be provided for replacement as required by the workers or applicable regulations. Disposable respirators shall not be used.

2. CONTRACTOR shall comply with OSHA 29 CFR Part 1926.134 and ANSI Standard Z88.2-1990 "Practices for 8-hour TWA, Respiratory Protection."

3. No worker shall be exposed to levels greater than 0.1 mg/m^3 respirable crystalline silica as determined by the protection factor of the respirator worn and the Work airborne area respirable crystalline silica levels.

4. Protective Clothing.

5. Workers shall be provided with sufficient sets of protective full-body clothing to be worn in the designated Work area whenever a potential exposure to respirable crystalline silica concentrations above the PEL exists. Such clothing shall include, but not be limited to coveralls and eye protection.

6. Protective clothing shall not be worn outside the Work area. Non-disposable-type protective clothing and footwear shall be left in the Work area.

7. Eye protection shall be provided and worn as required by applicable safety regulations. Equipment shall conform to ANSI Z87.1-1989.

8. Head Protection: Hard hats or other head protection shall be provided as required by applicable safety regulations. Hard hats shall conform to ANSI Z89.1-1991, Class A or B.

9. Foot Protection: Nonskid footwear shall be provided to all workers. Footwear shall conform to ANSI Z41.1-1993, Class 75.

10. Workers shall not eat, drink, smoke, or chew gum or tobacco in or near the respirable silica Work areas.

PART 3 – EXECUTION

Not used.

PART 4 – PAYMENT

Health and Safety Requirements will not be measured separately. There will be no separate payment for CONTRACTOR for implementation and compliance with the requirements of this Section. Full compensation for all CONTRACTOR implementation and compliance with this Section under the Contract shall be considered as included in the Contract unit or lump sum prices for the various items of the Contract to which the requirements of this Section relate.

END OF SECTION

SECTION 02050

DEMOLITION

PART 1 – GENERAL

1.01 SCOPE

Work under this section also includes demolition of remaining surface and Below Grade structures, on-Site crushing and pulverizing of concrete debris, decommissioning and removal of utilities and pipelines, and on-Site handling and segregation of debris for recycling or disposal. Known Constituents of Potential Concern (COPCs) on former building floor slabs and other structures include metals; lead containing paints; and polychlorinated biphenyls (PCBs). All COPCs, in addition to Volatile Organic Compounds (VOCs), may be encountered in the exposed Sub-Grade. CONTRACTOR'S CIH shall evaluate the personal protective equipment (PPE) requirements per task.

Work includes, but is not limited to:

A. Identify, locate, and backfill all underground utilities, not part of public property, unless otherwise noted on the Drawings.

B. Obtain all necessary permits and issue all applicable notifications for the project.

C. Demolish and remove concrete and asphalt pavements, floor slabs, Below Grade footings, foundations, pits, sumps, and other structures or other improvements and features on-Site unless otherwise noted on the Drawings. Blasting or the use of explosives at the Site will not be permitted.

D. Decommission pipelines and utilities.

E. Segregate various demolition debris based on their final disposition. All scrap steel MUST be shipped directly to a receiving facility for direct shipment to a smelter.

F. Crush uncontaminated concrete for use on-Site as unrestricted backfill and pulverize concrete with PCB concentrations greater than 1 mg/kg, but less than 3.5 mg/kg for use on-Site as restricted backfill, as approved by the City of Vernon, and US EPA.

G. Control and prevent dust emissions in accordance with requirements of SCAQMD and Section 01501 – Dust Control.

H. Remove railroad tracks and ties on and beneath the pavement, not designated for protection. Steel and treated railroad ties shall be stockpiled in accordance with the requirements of Section 02114 – Soil and Waste Stockpiling.

I. Protect adjacent sidewalks, utilities, pavements, walls, fences, monitor wells and facilities, designated for protection on the Drawings, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by the Site operations.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to the Work of this Section.

B. Section 01330 – Submittals and Procedures

C. Section 01501 - Dust Control

D. Section 02110 – Excavation of Contaminated Materials

E. Section 02114 - Soil and Waste Stockpiling

F. Section 02120 - Off-Site Transportation and Disposal

G. Section 02351 – Backfilling and Grading

1.03 SUBMITTALS

A. Prepare and provide Work submittal for demolition activities in accordance with requirements of Section 01330 – Submittals and Procedures.

B. Upon completion of Work, provide Project Record Drawings in accordance with requirements of Section 01770 – Contract Closeout.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 LOCATE UTILITIES

Prior to beginning demolition, CONTRACTOR shall notify Underground Service Alert (USA) to identify the location of all utilities in the Work area. CONTRACTOR shall coordinate with the utility OWNER(s) or operator(s) to confirm locations and whether the utilities have been disconnected.

Prior to the demolition of any remaining structures, CONTRACTOR shall make arrangements for the disconnection and termination of all remaining utilities such as water, sewer, storm, that enter the Site, in conformance with the requirements of the City of Vernon and companies owning or controlling them.

CONTRACTOR shall notify, in writing, the City of Vernon and companies concerned when such disconnections, terminations or reconnections are required. Perform the Work in accordance with their standard practices and requirements and under their supervision, or make arrangements for the Work to be performed with their forces, if required.

3.02 PREPARE FOR DEMOLITION

CONTRACTOR shall perform the following prior to beginning demolition activities and during demolition activities:

A. Record the locations and designation of survey markers and monuments prior to their removal. Provide three reference points for each survey marker and monument removed, established by a land surveyor licensed in the State of California.

B. Perform surveys as the Work progresses to detect potential hazards resulting from demolition activities.

C. Provide equipment capable of breaking and removing asphalt and concrete structures, as necessary to perform the Work.

D. Lead and silica dust exposure assessments will be required at the start of demolition and every new or alternate task and/or method. These exposure assessments shall be submitted by CONTRACTOR to ENGINEER prior to commencement of demolition activities or new or alternative tasks and/or methods. Downgrading from level C PPE will be decided based on the exposure assessment.

E. CONTRACTOR shall protect all Site features that are not designated for demolition.

3.03 DEMOLITION

CONTRACTOR shall perform Below Grade Demolition and Soil Excavation Work in phases, as described in the Specifications and shown on the Drawings.

The Site is paved with approximately equal areas with asphalt (approximately 245,000 square feet) and concrete (approximately 175,000 square feet). The pavement thicknesses vary. The average asphalt thickness is approximately 6 inches thick and the average concrete thickness is approximately 9 inches thick. CONTRACTOR may assume that the concrete pavement is un-reinforced.

Former building floor slabs comprise approximately 600,000 square feet. The floor slabs are reinforced concrete approximately 9 to 12 inches thick on partially raised grade (the concrete may be thicker or thinner in some sections). Areas of known slab thicknesses are shown on the Drawings. In some areas where wood block flooring previously existed, the concrete thickness is 6.5-inches, such as an area of approximately 38,000 square feet in the southeastern portion of Building 112A. Other historic areas of wood block floor covering were previously removed in the rest of the building and replaced with predominantly concrete overlay; in some areas, the overlay is asphalt. Steel tracks are embedded in the floor slab throughout the former building areas. Transite piping is present in some areas of former facility electrical substations.

There are several equipment foundation pits ranging from 4 to 70 feet in depth. Several foundations for former equipment and concrete pipe ducts are also present at the Site. CONTRACTOR shall demolish each structure and all contents to a depth of 10 to 12 feet Below Grade as shown on the Drawings. The remaining deeper portions of these structures can remain in place per the requirements of the Contract Documents. There are no known basements present. Selected historical facility Drawings are included in Appendix A.

CONTRACTOR shall apply water or employ other dust and odor control measures during demolition to prevent airborne dust or odors from leaving the Site property boundary, in accordance with SCAQMD regulations and Section 01501. ENGINEER will evaluate the conditions at the time of demolition and determine adequacy of CONTRACTOR'S dust or odor control measures. Demolition procedures or dust and odor control measures may have to be altered by CONTRACTOR based on ENGINEER'S observations of the effectiveness of such measures. ENGINEER has the authority to stop Work until such measures are improved, or additional or more effective measures are employed. ENGINEER may also stop Work when wind speed exceeds 10 miles per hour.

Specific demolition activities include the following:

A. Slabs and Pavements

CONTRACTOR shall demolish all slabs and pavements, including railroad tracks and ties present on the Site as shown on the Drawings, except those areas that are designated for protection. CONTRACTOR shall segregate railroad tracks and ties from slabs and pavements. Portions of the slabs impacted with PCBs are shown on the Drawings and will be delineated at the Site by ENGINEER. CONTRACTOR shall saw-cut or break, remove and direct-load or handle separately PCB-impacted slab areas designated for off-Site disposal as a TSCA hazardous waste and TSCA bulk remediation waste from those designated for on-Site reuse as Restricted Use fill. Upon commencing with Slab and Pavements demolition, CONTRACTOR shall initially remove and direct-load for off-Site disposal all PCB-impacted concrete slabs with concentrations greater than 50 mg/kg in all affected Phase Areas. CONTRACTOR shall then remove and direct-load for off-Site disposal all PCB-impacted concrete slabs with concentrations greater than 3.5 mg/kg but less than 50 mg/kg in all affected Phase Areas. PCB-impacted concrete with concentrations greater than 1 mg/kg but less than 3.5 mg/kg shall remain in place prior to pulverizing per the requirements of Section 02351, and until soil hot spot excavation Areas 4a and 4b are complete and ready for backfilling. CONTRACTOR shall then pulverize concrete with PCB concentrations greater than 1 but less than 3.5 for direct placement as Restricted Use fill in soil hot spot areas 4a and 4b. Owner may elect to direct-load Restricted Use fill concrete for off-Site disposal per the Owner-Option item as stated in the Bid Form. If the Owner option is selected, CONTRACTOR shall only size concrete for purposes of removal and handling instead of pulverizing for placement as Restricted Use fill. Remaining concrete and asphalt slabs and pavements not containing COPCs shall be demolished and concrete and asphalt debris shall be placed in separate stockpiles as specified in Section 02114. Concrete with PCB concentrations less than 1 mg/kg shall be crushed to the gradations as specified in Section 02351 and reused on Site as Unrestricted Use fill. Concrete with PCB concentrations greater than 1 mg/kg, but less than 3.5 mg/kg shall be pulverized to the gradations as specified in Section 02351 and reused on-Site as Restricted Use Fill. Asphalt debris shall not be crushed and reused as fill on-site but shall be recycled or disposed off-Site as specified in Section 02120.

CONTRACTOR shall perform periodic Work Area Air Monitoring as specified in Section 01900, for potential COPCs in subslab soil, during Slab and Pavements Demolition. CONTRACTOR shall immediately notify ENGINEER of visibly stained soil or noticeable odors in soil encountered during Slab and Pavements Demolition.

B. Former Building Foundations and Footings

Former building foundations and footings constructed of reinforced concrete are present from the Slab Grade down to depths ranging from 7 to 12 feet Below Grade. CONTRACTOR shall expose then demolish and remove all portions of former building foundations and footings as shown on the Drawings. CONTRACTOR shall perform any necessary excavation activities as specified in Section 02110 and stockpile excavation material as specified in Section 02114. CONTRACTOR shall saw-cut or break, remove and handle separately PCB-impacted concrete from structures designated for either off-Site disposal as a TSCA hazardous waste and TSCA bulk remediation waste from those designated for on-Site reuse as Restricted or Unrestricted Use fill. Concrete debris associated with structure demolition shall be transferred to the appropriate stockpile as specified in Section 02114 for subsequent Crushing as described in the Specifications. Steel or other debris shall be stockpiled accordingly for recycling or disposal as specified in Section 02120.

C. Subsurface Pits, Sumps and Structures Extending Less Than 10-Feet Below Grade

CONTRACTOR shall demolish and remove all subsurface pits, sumps, structures and associated piping and appurtenances located less than 10-feet Below Grade in their entirety as shown on the Drawings. CONTRACTOR shall not backfill open areas until ENGINEER has inspected the subsurface and sampled the underlying area for purposes of obtaining regulatory closure. Once structure is removed, CONTRACTOR shall notify ENGINEER. CONTRACTOR shall provide reasonable assistance to ENGINEER with sample collection efforts. ENGINEER will require seven working days to obtain conformational soil analytical results before area can be backfilled. CONTRACTOR shall saw-cut or break, remove and handle separately PCB-impacted concrete from structures designated for either off-Site disposal as a TSCA hazardous waste and TSCA bulk remediation waste from those designated for on-Site reuse as Restricted or Unrestricted Use fill. Concrete debris associated with structure demolition shall be transferred to the appropriate stockpile as specified in Section 02114 for subsequent Crushing as described in the Specifications. Steel or other debris shall be stockpiled accordingly for recycling or disposal as specified in Section 02120.

D. Subsurface Structures Extending Greater Than 10-Feet Below Grade

CONTRACTOR shall demolish structure and all contents from Slab Grade down to a depth of 10-feet Below Grade as shown on the Drawings. CONTRACTOR shall saw-cut or break, remove and handle separately PCB-impacted concrete from structures designated for either off-Site disposal as a TSCA hazardous waste and TSCA bulk remediation waste from those designated for on-Site reuse as Restricted or Unrestricted Use Fill. CONTRACTOR shall remove any residual demolition debris from remaining subsurface portion of structure then perforate base of structure with minimum four-inch diameter openings at a rate of one perforation per every 100 square-feet of structure floor area. Once perforated, CONTRACTOR shall backfill remaining subsurface portions of structure with Pea Gravel as specified in Section 02351, from the base of structure to a depth of 10-feet Below Grade. CONTRACTOR shall vibrate Pea Gravel during placement to minimize future settlement. Once backfilled with Pea Gravel, the entire surface of the remaining structure shall then be capped with a six-inch thick layer of Portland cement concrete as specified in Section 02351 and as shown on the Drawings. The location and extent of the remaining portions of the subsurface structure shall then be recorded in the Project Record Drawings. Concrete debris associated with structure demolition shall be transferred to the appropriate stockpile as specified in Section 02114 for subsequent Crushing as described in the Specifications. Steel or other debris shall be stockpiled accordingly for recycling or disposal as specified in Section 02120.

The deeper structures that have been identified for removal only down to 10-feet Below Grade with the remaining deeper portions decommissioned in place include, but are not limited to, the following.

1. A vertical pit (#1FDC) located in former Building 104 measuring approximately 20 feet in width (W) by 25 feet in length (L) by 35 feet deep (D), and an associated utility pit measuring 10 feet W by 10 feet L by 35 feet D. Both concrete pits extend to approximately 30 to 35 feet below the building floor Slab Grade, and the vertical pit contains a hydraulic ram that extends to a depth of 70 feet below the floor Slab. Hydraulic fluids within the hydraulic ram shall be removed and containerized for disposal. The upper portion of the Ram, assembly and appurtenances shall be removed to a depth of 12 – feet Below Grade. The lower portions of the hydraulic ram deeper than 12 - feet Below Grade shall be left in place.

2. A cooling tower water reservoir measuring approximately 20 feet W by 20 feet L by 12 to 16 feet D, and an adjacent Hot Well, in an area located on the southwest boundary of the Site adjacent to Boyle Avenue.

Other specific man-made structures located outside the former building footprints that are proposed for demolition are located south of the railroad track and include a truck scale, and slabs and footings associated with former Buildings 135, 136 and a Loading Dock located on Parcel 6.

E. Previously Backfilled Subsurface Structures Extending Greater Than 10-Feet Below Grade.

1. Several previously backfilled and decommissioned deeper structures are present at the Site that extend from the Slab Grade to depths greater than 10-feet Below Grade, as shown on the Drawings. CONTRACTOR shall demolish previously backfilled subsurface structures from Slab Grade down to a depth of 10-feet Below Grade. CONTRACTOR shall saw-cut or break, remove and handle separately PCB-impacted concrete from structures designated for either off-Site disposal as a TSCA hazardous waste and TSCA bulk remediation waste from those designated for on-Site reuse as Restricted or Unrestricted Use fill. Demolition debris and fill materials shall be removed from the surface of the remaining structure down to 10-feet Below Grade then CONTRACTOR shall cap the entire remaining surface of the structure with a minimum six-inch thick layer of Portland Cement Concrete as specified in Section 02351 and as shown on the Drawings. The remaining portions of the subsurface structure shall then be recorded in the Project Record Drawings. Concrete debris associated with structure demolition shall be transferred to the appropriate stockpile as specified in Section 02114 for subsequent crushing as described in the Specifications. Steel or other debris shall be stockpiled accordingly for recycling or disposal as specified in Section 02120.

   The previously backfilled in place man-made subsurface structures that extend deeper than 10-feet Below Grade include, but are not limited to, the following:

   a. Two deep pits (former Swindell Furnace Pits) located in former Building 110. These pits were formerly backfilled in place and capped with concrete. The circular shaped concrete caps are visible at the Slab Grade in former Building 110. Each pit measures approximately 18 feet in diameter and extends to a depth of approximately 60 to 63 feet below Slab Grade.

   b. One vertical pit (#4 FDC) and an associated Utility Pit, both located in former Building 104. The vertical pit measures approximately 15 feet W by 18 feet L by 37 feet D, with steel sheet piling walls extending down to 47 feet and a hydraulic ram extending from 37 to 61 feet below Slab Grade. The associated Utility Pit measures 10 feet W by 10 feet L by 37 feet D. Based on information provided by a former ALCOA Employee, these pits were decommissioned in 1986 to1987 and the hydraulic ram was reportedly left in place. The exact locations of these pits are not known but are reported to be located as shown in the Drawings.

   c. Two shallow pits (#1DC and #2DC) located in the northwest corner of former Building 104. These pits were backfilled and capped with concrete. Based on information provided by a former ALCOA employee, these pits extend to a depth of about 12 feet below the Slab Grade and the hydraulic rams associated with the pits may extend to about 20 to 24 feet Below Grade. The #1DC unit was decommissioned prior to 1974, and the #2DC unit was decommissioned in about 1974 to 1975. Documentation regarding these pits is limited. The exact locations of these pits are not known but are reported to be located as shown in the Drawings.

F. Utilities and Pipelines

CONTRACTOR shall remove all utilities and pipelines existing at Grade or beneath the floor slab to a depth of 3-feet Below Grade. Remaining or residual contents from utilities and pipelines shall be collected and containerized for disposal by CONTRACTOR as specified in Section 2120. ENGINEER will sample removed contents for waste disposal profiling purposes. CONTRACTOR shall provide reasonable assistance to ENGINEER with sample collection efforts. Soil excavation necessary to support utility and pipeline removal shall be performed as specified in Section 02110, and stockpiled as specified in Section 2114. CONTRACTOR shall backfill all excavated utility and pipeline trenches as specified in Section 2351. ENGINEER will determine if further excavation of material is required by CONTRACTOR during utilities and pipeline removal.

CONTRACTOR shall backfill in place by filling with cement slurry as specified in Section 02351 all utilities and pipelines that exist beneath the floor slab at greater than 3-feet Below Grade unless otherwise specified by ENGINEER. These utilities and pipelines include, but are not limited to, sewer lines, pipelines, backfilled stormwater lines, electrical conduits, and utility piping. CONTRACTOR shall maintain active stormwater conveyance systems to comply with the Site-specific SWPPP. CONTRACTOR shall cut and cap all other utilities and pipelines at the property line that extend beyond the property line. CONTRACTOR shall backfill excavations conducted at property line to cut and cap utilities after inspected and approved by ENGINEER. CONTRACTOR shall record details of the locations of all utilities encountered during the Below Grade Demolition Work in the Project Record Drawings as specified in Section 01770.

CONTRACTOR shall provide all necessary labor, equipment, and material to remove transport, and dispose of Transite Pipe in accordance with all federal, state, and local regulations, and standards of the industry, including Asbestos Hazard and Emergency Response Act (AHERA). Work includes required permits, notifications, enclosures, and required air monitoring.

3.04 CRUSHING

A. All concrete not impacted with COPCs that exceed risk-based cleanup levels, (including concrete with PCB concentrations less than 1 mg/kg, but excluding concrete with PCB concentrations greater than 1 mg/kg, but less than 3.5 mg/kg) shall be crushed on-Site to the gradations of Greenbook 200-2.4 or equivalent, for re-use as Unrestricted Use backfill as described in Section 02351. CONTRACTOR shall apply dust and noise control measures, perform personal exposure assessments, and other applicable control measures during crushing, stockpiling and backfilling.

B. Work includes all permitting associated with crusher operations, handling, stockpiling and any necessary stockpile relocation or consolidation, concrete sizing to maximum dimensions of two-feet by two-feet by one-foot to facilitate crushing activities, operation of scales for measurement of crushed materials, removal or cutting of reinforcement steel or rebar within one-inch of sized concrete surfaces, crushing, and stockpiling management. Crushing also includes placement and compaction of Aggregate Base into open excavation areas as backfill as described in Section 02351 and as shown on the Drawings. Steel or other debris (including asphalt debris) shall be stockpiled accordingly for recycling or disposal as specified in Section 02120.

C. To eliminate potential cross-contamination of Unrestricted Use crushed concrete (that containing PCB concentrations less than 1 mg/kg) with Restricted Use crushed concrete (that containing PCB concentrations greater than 1 mg/kg), CONTRACTOR shall thoroughly decontaminate all handling and sizing equipment or provide separate, dedicated handling and sizing equipment at CONTRACTOR'S expense for processing of Unrestricted and Restricted Use concrete materials. If CONTRACTOR elects to not provide separate, dedicated equipment, CONTRACTOR cannot crush or handle Unrestricted Use concrete after crushing or handling Restricted Use concrete, until CONTRACTOR thoroughly decontaminates the crushing and handling equipment then performs wipe sample testing for the presence of PCBs on each component of the crushing and handling equipment. CONTRACTOR shall provide results to ENGINEER and CONTRACTOR cannot proceed with additional crushing or handling of Unrestricted Use concrete until written approval is provided by ENGINEER.

3.05 PULVERIZING

A. All concrete impacted with PCBs with concentrations greater than 1 mg/kg, but less than 3.5 mg/kg shall be pulverized to the gradations described in Section 02351 and placed as Restricted Use Fill where indicated on the Drawings.

B. CONTRACTOR shall not use handling and sizing equipment on Unrestricted Use concrete materials after performing concrete pulverizing, handling and placement until all equipment is thoroughly decontaminated and wipe sample-tested as described above.

C. Pulverizing also includes removal or cutting of reinforcement steel or rebar within one-inch of sized concrete surfaces, applicable dust controls, equipment decontamination, and materials management, including placement and compaction of pulverized concrete into open excavation areas as backfill as described in Section 02351 and as shown on the Drawings. Steel or other debris (including asphalt debris) shall be stockpiled accordingly for recycling or disposal as specified in Section 02120.

3.06 DISPOSAL

A. CONTRACTOR shall dispose of removed or demolished materials at OWNER-approved off-Site facilities in accordance with Section 02120.

B. Burying or burning of trash and debris on-Site will not be permitted.

3.07 CLEANUP

A. Maintain a clean and orderly Site. CONTRACTOR shall clean up Site as required in accordance with Section 01500, during and at the completion of Below Grade Demolition and Soil Excavation Work. CONTRACTOR shall dispose of waste and trash generated by CONTRACTOR in a safe, acceptable manner at CONTRACTOR'S expense.

B. Decontaminate all equipment that came into contact with COPCs prior to using for another purpose or leaving the Site as specified in Section 01500.

C. Conduct final maintenance and cleaning of the SWPPP stormwater control measures prior to demobilization. Removal and disposal of the SWPPP measures will be performed by others.

PART 4 – PAYMENT

A. Demolition of Slabs and Pavements will be measured as a Lump Sum for each Phasing Area as shown on the Drawings. Payment for Slabs and Pavements will be made at the contract unit price (Lump Sum) as stated in the Bid Form for each Phasing Area and shall include full compensation for all CONTRACTOR materials, equipment, labor and supplies as required for Demolition of Slabs and Pavements as described in Section 02050-Demolition.

B. Demolition of Foundations and Footings will be measured as a Lump Sum for each Phasing Area as shown on the Drawings. Payment for Foundations and Footings will be made at the contract unit price (Lump Sum) as stated in the Bid Form for each Phasing Area and shall include full compensation for all CONTRACTOR materials, equipment, labor and supplies as required for Demolition of Foundations and Footings as described in Section 02050-Demolition.

C. Demolition of Subsurface Pits, Sumps, and Structures Extending Less Than 10-Feet Below Grade will be measured as a Lump Sum for each Phasing Area as shown on the Drawings. Payment for Subsurface Pits, Sumps, and Structures Extending Less Than 10-Feet Below Grade will be made at the contract unit price (Lump Sum) as stated in the Bid Form for each Phasing Area and shall include full compensation for all CONTRACTOR Work as required for Demolition of Subsurface Pits, Sumps, and Structures Extending Less Than 10-Feet Below Grade as described in Section 02050-Demolition.

D. Demolition of Subsurface Pits, Sumps, and Structures Extending Greater Than 10-Feet Below Grade will be measured as a Lump Sum for each Phasing Area as shown on the Drawings. Payment for Subsurface Pits, Sumps, and Structures Extending Greater Than 10-Feet Below Grade will be made at the contract unit price (Lump Sum) as stated in the Bid Form for each Phasing Area and shall include full compensation for all CONTRACTOR Work as required for Demolition of Subsurface Pits, Sumps, and Structures Extending Greater Than 10-Feet Below Grade as described in Section 02050-Demolition.

E. Demolition of Previously Backfilled Subsurface Structures Extending Greater Than 10-Feet Below Grade will be measured as a Lump Sum for each Phasing Area as shown on the Drawings. Payment for Previously Backfilled Subsurface Structures Extending Greater Than 10-Feet Below Grade will be made at the contract unit price (Lump Sum) as stated in the Bid Form for each Phasing Area and shall include full compensation for all CONTRACTOR Work as required for Demolition of Previously Backfilled Subsurface Structures Extending Greater Than 10-Feet Below Grade as described in Section 02050-Demolition.

F. Utilities and Pipelines will be measured as a Lump Sum for each Phasing Area as shown on the Drawings. Payment for Utilities and Pipelines will be made at the contract unit price (Lump Sum) as stated in the Bid Form for each Phasing Area and shall include full compensation for all CONTRACTOR Work as required for Utilities and Pipelines as described in Section 02050-Demolition.

G. Crushing of concrete debris will be measured as a unit cost (Per Ton) for all Crushing Work, based on daily scale weight print-outs from CONTRACTOR-operated scales integrated into the Crushing equipment. Payment for Crushing will be made at the contract unit price (Ton) and shall include full compensation for all CONTRACTOR Work for Crushing as specified in Sections 02050 – Demolition.

H. Pulverizing of concrete debris will be measured as a unit cost (Per Square Foot) for all Pulverizing Work, based on PCB-impacted concrete areas with PCB concentrations greater than 1 mg/kg, but less than 3.5 mg/kg as shown on the Drawings. Payment for Pulverizing will be made at the contract unit price (Square Foot) and shall include full compensation for all CONTRACTOR Work for Pulverizing as specified in Sections 02050 – Demolition.

I. Demolition of Transite Pipe or other ACM wastes as described in Section 02050 will not be measured separately. It is considered incidental to Off-Site Transportation and Disposal of Transite Pipe or other ACM wastes as described in Section 02120 – Off-Site Transportation and Disposal.

END OF SECTION

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SECTION 02110

EXCAVATION OF CONTAMINATED MATERIALS

PART 1 – GENERAL

1.01 SCOPE

This section includes the following:

A. Excavation of contaminated material from areas shown on the Drawings.

B. Placement of the material in either a stockpile area or directly into trucks for off-Site disposal.

C. Additional excavation, on-Site transportation, and staging as directed by ENGINEER, based on field indications of contamination or analytical results of confirmation samples.

D. Performance of all Excavation activities in compliance with CONTRACTOR'S Health and Safety Plan, including PPE selection, air monitoring and PPE upgrades, based on CONTRACTOR'S Monitoring of Site conditions.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to the Work of this Section.

B. Section 01110 – Summary of Work

C. Section 01501 - Dust Control

D. Section 01560 - Site Security

E. Section 01770 – Contract Closeout

F. Section 02114 – Contaminated Soil and Waste Stockpiling

G. Section 02120 - Off-Site Transportation and Disposal

H. Section 02260 – Excavation Support and Protection

I. Section 02351 - Backfilling/Grading

1.03 DEFINITIONS

Contaminated Materials: Site soil or debris impacted with COPC's.

Incidental Excavation: Excavation of soil, material and debris associated with the removal, exposure or demolition of slabs and pavements; former foundations and footings; subsurface pits, sumps and structures; previously abandoned subsurface structures; and utilities and pipelines. Incidental excavation also applies to soil, material and debris that would otherwise not require excavation based on known COPCs, but requires handling due to proximity with structures identified for removal in Below Grade Demolition Work; or other non-contaminated material located in proximity to Soil Excavation areas that may require excavation for purposes of sidewall or excavation stability.

1.04 SUBMITTALS

A. Daily Excavation Quantity Summaries: CONTRACTOR shall prepare a summary of estimated excavation quantities at the end of each day that soil excavation is performed. These quantities shall be subject to revision for payment purposes based on subsequent measurements that are more precise, and reviewed by ENGINEER. CONTRACTOR shall submit Daily Excavation Quantity Summaries to ENGINEER on a weekly basis.

Utility location diagrams. CONTRACTOR shall submit utility location diagrams to ENGINEER 48 hours (minimum) prior to the start of any excavation at the Site.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 EXCAVATION OF CONTAMINATED MATERIALS

A. The initial excavation boundaries for each Excavation Area are shown on the Drawings.

B. CONTRACTOR is responsible for locating all utilities within or near each excavation area and documenting those locations on the ground and on a diagram submitted to ENGINEER at least 48-hours prior to performance of any excavation. CONTRACTOR is responsible for properly terminating any abandoned utility that is disrupted and providing Northing, Easting and elevation data so that the terminus can be relocated.

C. CONTRACTOR shall excavate soil from each Excavation Area shown on the Drawings or as otherwise directed by ENGINEER. CONTRACTOR shall not perform excavation Work unless ENGINEER'S representative is present.

D. CONTRACTOR shall provide dust and odor control measures in accordance with Section 01501 – Dust Control.

E. CONTRACTOR shall monitor all excavated soil for volatile organic compounds (VOCs) in accordance with applicable federal, state, and local regulations, standards, and codes including SCAQMD Rule 1166, OSHA, CAL OSHA, and CONTRACTOR'S Health and Safety Plan.

F. CONTRACTOR shall implement measures to limit the entry of storm water to the excavations, such as installation of temporary berms or pumping around the excavation. The methods to be used by CONTRACTOR to minimize impacts from storm water run-on shall be described in the Construction Plan.

G. After the initial excavation, the area will be inspected by ENGINEER to determine if the excavation needs to be increased in size or depth. Further required excavation by CONTRACTOR will only be performed at the direction of ENGINEER.

H If workers are to enter excavations 4 feet below Grade surface or greater, access ramps or other means of egress must be provided by CONTRACTOR. If workers are to enter excavations 5 feet below Grade surface or greater, CONTRACTOR shall provide shoring, benching or sloping in accordance with all applicable federal, state, and local regulations. CONTRACTOR shall segregate any soil removed for benching, ramping, or sloping areas that are outside the initial extent of excavation and stockpile and manage this soil within the excavation separately from COPC-impacted soil, or in accordance with Section 02114 – Soil and Waste Stockpiling. ENGINEER will perform sampling and analysis of sloping and benching material to determine its final disposition within seven calendar days of its generation. If directed by ENGINEER, CONTRACTOR shall place and compact benching and sloping material within the excavation in accordance with 02351 – Backfilling and Grading at no additional cost to OWNER. If directed by ENGINEER, CONTRACTOR shall dispose of this material off-Site in accordance with Section 02120 – Off-Site Transportation and Disposal.

I. CONTRACTOR shall provide all shoring, bracing, benching, or sloping required to protect adjacent structures and traffic as described in Section 02260 – Excavation Support and Protection.

J. Excavated COPC-contaminated soil shall be stockpiled in such a manner that prevents contamination of or mixture with uncontaminated soil, as described in Section 02114 – Contaminated Soil and Waste Stockpiling.

K. After completion of hot spot soil excavation and confirmation sampling in Area 4a but prior to backfilling, CONTRACTOR shall cap the entire excavation floor area with a six-ich thick layer of Portland cement concrete as specified in Section 02351 and shown on the Drawings. The remaining area shall be backfilled with PCB-impacted concrete as directed by ENGINEER, then covered with an identifier layer and an Interim Cap, per US EPA requirements.The location and extent of the concrete cap shall then be recorded in the Project Record Documents.

3.02 INCIDENTAL EXCAVATION TO REMOVE STRUCTURES

A. CONTRACTOR shall perform Incidental Excavation as necessary to expose or remove structures identified for demolition as shown on the Drawings.

B. CONTRACTOR shall perform all requirements necessary for Excavation of Contaminated Materials during performance of Incidental Excavation. If CONTRACTOR'S Rule 1166 monitoring indicates Incidental Excavation material may contain COPCs or if directed by ENGINEER, CONTRACTOR shall handle and stockpile the material in accordance with Section 02114 – Contaminated Soil and Waste Stockpiling.

3.03 SOIL SAMPLING

A. ENGINEER is responsible for soil profiling and the collection and analysis of soil samples to identify potential environmental impacts.

B. CONTRACTOR shall provide equipment and personnel available to assist ENGINEER with soil sample collection in excavations 4 feet deep or greater. This equipment is anticipated to consist of a backhoe or equivalent.

C. CONTRACTOR shall anticipate a three calendar day turn around time once received by the testing laboratory, for the results of soil samples collected from the base and sidewalls of the Excavation Areas shown on the Drawings. During this period, CONTRACTOR shall not backfill the subject portion of the excavation, and shall maintain all necessary Site controls. Based on the results of the soil sample analysis, ENGINEER may direct CONTRACTOR to perform additional excavation or to backfill and restore the excavation area. No payment will be made for standby or delay claims while waiting for soil sample results.

3.04 PROTECTION OF EXISTING FACILITIES

A. CONTRACTOR shall be responsible for locating existing utilities and protecting existing structures to be left in place, including roads, building foundations, buried utilities, and other above ground and buried structures.

B. CONTRACTOR shall not begin excavation at the Site without written authorization from ENGINEER. This authorization will verify that the extent of excavation has been marked in the field and that CONTRACTOR has submitted documentation to ENGINEER that indicates that CONTRACTOR has obtained clearance for potential buried utilities within each excavation area. If known utilities are present in the vicinity of the excavation, CONTRACTOR will indicate and verify that they have been marked by the appropriate utility, and that markings are still visible in the field. CONTRACTOR shall also contact OWNER'S of utilities identified by CONTRACTOR to be within the excavation areas and convey any special excavation restrictions obtained from the OWNER'S of those utilities to ENGINEER. CONTRACTOR shall comply with these excavation restrictions. CONTRACTOR is responsible for protecting underground utilities at the Site during completion of the Work and shall repair at its own expense all damage to underground utilities caused by the Work.

C. Unless otherwise authorized by the OWNER, all utilities are to remain in place in their current alignment and CONTRACTOR shall protect and support them in place during completion of excavation and backfill activities. It is CONTRACTOR'S responsibility to obtain approval from the respective utility companies for protection and support measures and to present such measures for ENGINEER'S approval.

D. CONTRACTOR shall replace in kind and at its own expenses any Site features shown on the Drawings as to be protected that are damaged by CONTRACTOR during the Work.

PART 4 – PAYMENT

A. Excavation of Contaminated Material will be measured as a unit cost (per CY) for all Contaminated Material excavated and placed in a stockpile per the requirements of Section 02114. Measurement will be made as calculated in the stockpile location. Contaminated soil stockpile areas shall be surveyed horizontally and vertically, to the nearest 0.1 foot, upon stockpile area construction and prior to any contaminated soil placement. Contaminated soil stockpiles shall be surveyed immediately after completion of contaminated soil placement, to the same tolerance criteria. CONTRACTOR shall remove stockpile cover during final survey, or demonstrate to ENGINEER that no void spaces exist under the cover. Soil volume shall be calculated based on the survey data. Surveying shall be performed as specified in Section 01770 – Contract Closeout. Payment for Excavation of Contaminated Material will be made at the Contract unit price (CY) as stated in the Bid Form Payment for Hot Spot Soil Excavation of PCB-impacted Soil, Metals-impacted Soil, VOC-impacted Soil, and Stoddard Solvent-Impacted Soil removed from each Soil Excavation Area and shall include full compensation for all CONTRACTOR Work for Excavation of Contaminated Material as specified in Section 02110 and shown on the Drawings.

B. Incidental Excavation will not be measured separately. It is considered incidental to expose or remove structures identified for demolition as shown on the Drawings.

C. Placement of Portland cement concrete cap in base of completed excavation prior to backfilling in Area 4a will not be measured separately. It is considered incidental to Excavation of Contaminated Material, specifically PCB-Impacted Soil.

END OF SECTION

SECTION 02114

SOIL AND WASTE STOCKPILING

PART 1 – GENERAL

1.01 SCOPE

The Work under this Section covers the requirements for stockpiling materials at the Site. Materials shall be stockpiled pending classification for reuse, additional handling, or disposal.

CONTRACTOR shall supply all materials, equipment, and services required for excavating, loading, hauling, and stockpiling operations.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to the Work of this Section.

B. Section 01502 – Storm Water Management

C. Section 02120 – Off-Site Transportation and Disposal

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 MATERIAL SEGREGATION

A. Materials shall be segregated for stockpiling based on the results of previous testing or evaluation by ENGINEER. Anticipated categories of material that will be generated on-Site include but are not limited to the following:

1. Incidental Excavation soil.
2. Excavated soil, as based on Rule 1166 monitoring results.
3. PCB-impacted hot spot soil excavation.
4. VOC-impacted hot spot soil excavation.
5. Metals-impacted hot spot soil excavation.
6. TPH-impacted hot spot soil excavation.

7. Concrete demolition debris containing PCBs less than 1 mg/kg for on-Site crushing and reuse as unrestricted fill.

8. Concrete demolition debris containing PCBs greater than 1 mg/kg, but less than 3.5 mg/kg for on-Site crushing and reuse as restricted fill.

9. Asphalt demolition debris for off-Site recycling.

10. PCB-impacted concrete and asphalt demolition debris for off-Site waste disposal.

11. Other demolition debris including piping, equipment, steel, and asbestos-containing material.

12. Pea Gravel or other backfill material removed during demolition of Previously Backfilled and Decommissioned Structures.

B. CONTRACTOR shall establish and maintain separate stockpiles for different categories of material and maintain segregation of the materials in the separate stockpiles, as required by ENGINEER.

C. CONTRACTOR shall direct load all hot spot excavated soil and concrete containing PCBs greater than 50 mg/kg, into hauling vehicles or ENGINEER-approved waste bins for off-site transport and disposal in accordance with Section 02120-Off-Site Transportation and Disposal. Under no circumstances shall CONTRACTOR stockpile these materials on-Site unless otherwise approved in writing by ENGINEER, and in compliance with the requirements of 40 CFR 761.65.

3.02 MATERIAL PLACEMENT AND STOCKPILE MAINTENANCE

A. CONTRACTOR shall regularly inspect and maintain stockpiles until the stockpiled material is either transported off-Site, processed through concrete crushing activities, or stockpile is disassembled.

B. Stockpiles shall be protected from storm water run-on/run-off and shall have effective erosion and sedimentation control features in accordance with Section 01502 – Storm Water Management. All materials placement shall be in accordance with the requirements of the SWPPP.

C. Stockpiles shall be placed on existing asphalt or concrete pavements or slabs, or native soil, and the perimeter or sides shall be bermed and contained with K-rails or other ENGINEER-approved means.

D. A 10-mil polyethylene liner shall be placed over the existing surface and over the K-rails or perimeter berms to form a basin prior to stockpiling any materials. During the course of the Work, ENGINEER may elect to allow CONTRACTOR to temporarily stockpile certain PCB-impacted materials that are not direct-loaded for disposal, and require CONTRACTOR to use a 30-mil polyethylene bottom liner or equivalent for all excavated soil, removed concrete, or other materials suspected to contain PCBs greater than 3.5 mg/kg but less than 50 mg/kg, per the requirements of 40 CFR 761.65 c(9). CONTRACTOR shall assume that excavated soil, removed concrete or other debris suspected to contain PCBs greater than 1 mg/kg but less than 3.5 mg/kg that is temporarily stockpiled, shall be treated in a manner similar as materials containing PCBs greater than 3.5 mg/kg, unless directed otherwise by ENGINEER. All material stockpiles shall remain covered with weighted 10-mil polyethylene sheeting after each material placement operation and during periods of inactivity.

E. CONTRACTOR shall take care to minimize damage to plastic sheeting during soil, concrete, material or debris placement and loading activities. CONTRACTOR shall repair or replace damaged plastic sheeting before the end of each work day and immediately upon completion of each material placement or loading event.

F. Before the end of each work day, CONTRACTOR shall inspect stockpile areas to assure stockpiled material is suitably contained and controlled, and has not come into contact with the adjacent or underlying soil or pavement. CONTRACTOR shall immediately collect all stockpiled material that is observed by CONTRACTOR, OWNER, or ENGINEER to not be contained or controlled and re-stockpile the material per the requirements of this section.

G. Concrete demolition debris containing PCBs less than 1 mg/kg intended for on-Site crushing, and crushed recycled aggregate piles for use as unrestricted fill do not require bottom liners. CONTRACTOR shall not locate any waste bins or construct any stockpiles within 30 feet of perimeter Site property boundaries or as shown on the Drawings. No stockpiles or waste bins are allowed in the northeast parking lot area within 200 feet of any perimeter Site property boundaries or as shown on the Drawings. Maximum stockpile height shall not exceed 25 feet.

H. CONTRACTOR shall not place any stockpile impacted with COPCs within 10-feet of any adjacent stockpile unless directed by ENGINEER.

I. CONTRACTOR shall not construct stockpiles in locations that negatively impact existing storm drains, outfalls, or catch basins.

J. CONTRACTOR shall be responsible for the relocation or moving and re-stockpiling of any waste bins, stockpiles or stockpiled materials that obstruct or hinder Site areas requiring subsequent demolition, excavation or backfilling, at no additional cost to OWNER.

K. CONTRACTOR shall be responsible for disassembly, removal and proper disposal of stockpile areas and stockpile materials.

3.03 WASTE CLASSIFICATION TESTING

ENGINEER will perform sampling and analysis to classify stockpiled materials, including PCB-impacted soil and concrete intended for removal but still in place, for disposal. ENGINEER will collect waste classification samples within two days of receipt of a written request from CONTRACTOR confirming that either the hot spot area is excavated and stockpiled, or at least 500 cubic yards of stockpiled soil from a larger hot spot area is ready to be sampled. CONTRACTOR shall profile PCB-impacted soil and concrete shown on the Drawings based on pre-existing characterization data collected by ENGINEER. It is anticipated that PCB-impacted concrete will be encountered during the course of the work that will require analytical testing for waste classification. CONTRACTOR shall anticipate a minimum of seven working days for ENGINEER to test and provide the results of these materials to CONTRACTOR once samples are collected. CONTRACTOR shall anticipate a seven working day turn around time for the results of waste classification samples.

3.04 DISPOSAL

CONTRACTOR shall not dispose of any stockpiled materials until a waste profile is completed, the receiving facility has accepted the material for disposal, and approval has been obtained from ENGINEER. Once materials are profiled and accepted for disposal, CONTRACTOR shall load and ship or otherwise remove stockpiled material from the Site within 14 calendar days. In addition to these requirements, CONTRACTOR shall load and ship all PCB-impacted soil and concrete greater than 3.5 mg/kg off-Site within 30 days of generation. CONTRACTOR shall manage transportation and off-Site disposal of excavated soil and demolition debris, as specified in Section 02120 - Off-Site Transportation and Disposal.

PART 4 – PAYMENT

Soil and Waste Stockpiling will not be measured separately. Stockpiling is considered incidental to excavation, demolition or other material generating and handling activities. There shall be no separate payment for CONTRACTOR or Subcontractor incidentals pursuant to implementation and compliance with the requirements of this Section. Full compensation for all CONTRACTOR implementation and compliance with this Section under this Contract shall be considered as included in the Contract unit or lump sum prices for the various items of the Contract to which the requirements of this Section relate.

END OF SECTION

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SECTION 02120

OFF-SITE TRANSPORTATION AND DISPOSAL

PART 1 – GENERAL

1.01 SCOPE

A. CONTRACTOR shall be responsible for the removal and disposal of all wastes generated at the Site in association with the Work and all materials remaining on-Site at the end of the Work. Burying or burning of trash and debris on Site will not be permitted.

B. CONTRACTOR shall be responsible for making all arrangements for acceptance of waste generated during demolition of existing Site improvements and excavation of soil at OWNER-approved disposal facilities. Soils, concrete and other debris impacted with PCBs greater than 1 mg/kg are considered bulk PCB remediation waste. Porous wastes impacted with PCBs shall be disposed of in accordance with 40 CFR 761.61(a)(5)(i). Non-porous wastes impacted with PCBs shall be disposed of in accordance with 40 CRF 761.61 (a)(5)(i)(B)(2)(ii) and 761.61 (a)(5)(i)(B)(2)(iii), depending on their concentrations. Cleanup wastes impacted with PCBs, including non-liquid materials and spent PPE, shall be disposed of in accordance with 40 CFR 761.61 (a)(5)(v).

C. CONTRACTOR shall ensure that all storage, loading, and transportation of waste are in compliance with applicable federal, state, and local transportation regulations.

D. CONTRACTOR shall be responsible for storing and stockpiling wastes prior to disposal and for transporting wastes to off-Site disposal facilities approved by the OWNER.

E. CONTRACTOR shall supply all materials, equipment and services required for storage and transportation of wastes associated with the Work.

F. ENGINEER will be responsible for collecting soil samples for characterizing the waste to determine appropriate off-Site disposal options. PCB-impacted soil and concrete will be characterized by in-situ data collected by ENGINEER prior to and during the course of the Work. CONTRACTOR shall be responsible for waste profiling, manifesting, and other requirements of the receiving facility.

G. The OWNER or their Designated Representative will be responsible for signing all Hazardous Waste Manifests (hazardous) and Bills of Lading (Non-hazardous). The OWNER will be identified as Generator on all waste-related documents.

1.02 SUBMITTALS

A. Identification of Waste Transportation Subcontractors: CONTRACTOR shall obtain and submit to ENGINEER letters of commitment from waste transporters agreeing to handle any wastes generated by performance of the Work and shall attach the following information for each waste transportation company (This information shall be submitted within seven calendar days of a request from ENGINEER):

1. Name and EPA identification number.
2. A copy of the company's California Department of Transportation license.
3. Address and telephone number.
4. Name and telephone number of responsible contact.
5. List of types and sizes of all transport vehicles and equipment to be used.
6. A description of proposed transportation methods, schedules and procedures for hauling waste material, including type of vehicles that will be used for each class of waste and frequency of transport.
7. Any and all necessary permit authorizations for each class of waste transported.

B. Waste Manifests/Bills of Lading: CONTRACTOR shall prepare a manifest for each load of hazardous waste and Bill of Lading for each non-hazardous waste stream. As specified in Part 3.02, these manifests/Bills of Lading shall be delivered to the OWNER or the OWNER'S Designated Representative for their signature prior to shipment. This information shall be submitted a minimum of 48 hours prior to shipment.

C. Final Waste Manifest/Bills of Lading Records: CONTRACTOR shall submit completed waste manifest records to ENGINEER within seven calendar days after notification of receipt at the disposal facility. OWNER reserves the right to withhold payment for waste disposal for which the final Waste Manifest/Bills of Lading are not received.

D. Disposal Log: CONTRACTOR shall create and maintain a log for tracking disposal information for all wastes removed from the Site. The Disposal Log shall be in tabular format and include the following information for each load of material disposed:

1. Waste manifest number.
2. Date transported from the Site.
3. Source of the waste (e.g., location).
4. Date received at disposal facility.
5. Waste type (e.g. soil, municipal waste, etc.).
6. Load weight as measured at the disposal facility.
7. Name of disposal facility.

The CONTRACTOR'S Disposal Log shall be updated and submitted to ENGINEER every seven calendar days prior to the Weekly Progress Meeting and be current up to two working days prior to the meeting.

E. Disposal Facility Weight Records: CONTRACTOR shall submit copies of all weight records obtained from the disposal facilities. CONTRACTOR shall submit the weight record copies weekly, attached to the Disposal Log described in Paragraph D. OWNER reserves the right to withhold payment for waste disposal for which the final waste manifest/bills of lading are not received.

F. All metals shall be segregated and shipped directly to a receiving facility for smelting. Notify the receiving facility of the potential lead and/or PCB content of the metals. Provide letter of acknowledgement to ENGINEER.

1.03 PERMITS AND FEES

CONTRACTOR shall be responsible for obtaining and paying for all permits and fees required for completion of the Work.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 OFF-SITE TRANSPORTATION

A. CONTRACTOR shall transport wastes to off-Site locations approved by the OWNER.

B. CONTRACTOR shall only use the transporter(s) identified in CONTRACTOR'S approved submittals for the performance of Work. Any use of substitute or additional transporters must have previous written approval by ENGINEER. CONTRACTOR shall be responsible for any additional costs that may be incurred for utilizing alternate transportation.

3.02 MANIFEST PROCEDURES

A. CONTRACTOR shall utilize a state-approved manifest system so that wastes can be tracked from generation to ultimate disposal. The manifests must comply with all the provisions of the transportation and disposal regulations. CONTRACTOR shall be responsible for preparing manifests for each load a minimum of 48 hours prior to shipment. If the manifest is acceptable, the OWNER or their Designated Representative will provide the generator number and sign the generator's certification portion of the manifests. If the manifest is not acceptable, CONTRACTOR shall make all corrections at no additional cost to ENGINEER or OWNER.

B. CONTRACTOR shall be responsible for accurate and timely completion of final manifests. All transporters must sign the appropriate portions of the manifest and must comply with all of the provisions established in state and federal DOT regulations. The disposal facility must sign the appropriate portions of the manifest and return it to CONTRACTOR within 14 calendar days of disposal. OWNER reserves the right to withhold payment for waste disposal for which final manifests are not received.

3.03 SPILL PREVENTION

CONTRACTOR shall utilize appropriate hauling and transport vehicles and operating practices to prevent spillage or leakage of materials from occurring on-Site, off-Site, or en-route to associated disposal facilities.

3.04 CONTAMINATION PREVENTION

A. CONTRACTOR shall inspect all disposal loads to verify shipments are securely covered and contained prior to leaving the Site.

B. CONTRACTOR shall prevent Site materials from being tracked off-Site onto public right-of-ways. CONTRACTOR shall be responsible to assure thorough transport vehicle decontamination and inspections are performed before transportation vehicles leave the Site. All vehicles leaving Work areas shall be inspected by CONTRACTOR to ensure that no soil, concrete, or debris adheres to its wheels or exterior. At a minimum, CONTRACTOR shall brush off and remove any loose waste material from vehicle exterior and tires prior to any vehicle departing the Site. Any tracked soil, concrete or debris present in public right-of-ways shall be immediately collected and transferred to the CONTRACTOR'S stockpile or waste staging area at no additional expense to OWNER.

C. CONTRACTOR shall inspect daily the off-Site roadways adjacent to Site ingress/egress, and shall also inspect regularly along the designated routes into and out of the City of Vernon that any hauling vehicles take from the Site to the disposal destination to ensure that no leakage or tracking of mud or soil, concrete, debris or other materials has occurred. If contaminated or other materials resulting from leakage or tracking are observed in adjacent City right-of-ways or along the designated roadways, CONTRACTOR shall immediately notify ENGINEER and immediately clean the area at CONTRACTOR'S expense and modify procedures as necessary to prevent recurrence.

D. CONTRACTOR shall be responsible for any and all actions necessary to remedy situations involving materials spilled in transit or mud and dust-tracked off-Site. This cleanup shall be accomplished at the CONTRACTOR'S expense.

3.06 HAULING AND DISPOSAL SCHEDULE

A. CONTRACTOR'S schedule shall be compatible with waste stockpiling space limitations, excavation production and PCB-impacted concrete removal rates, the availability of equipment and personnel for material handling operations, the availability of hauling vehicles, and any City of Vernon requirements as related to hauling vehicles, hours of operation, and haul routes in City right-of-ways.

B. CONTRACTOR shall coordinate the schedule for truck or other transportation vehicle arrivals at the Site and at the disposal facility within designated hours of operation, and to meet the approved project schedule.

C. Slowing or stopping of excavation or concrete removal Work by CONTRACTOR for reasons of lack of transportation, availability of transportation vehicles or shipping containers will not be acceptable.

D. Loading and off-Site shipment of soil, concrete, wastes or other debris shall be limited to the hours of 6:00 a.m. to 6:00 p.m., Monday through Friday, or as specified and approved by ENGINEER. Any vehicle loaded after receiving facility hours of operation shall remain parked at the Project Site in a designated area of the Site until such time as the vehicle may reasonably proceed to the designated receiving facility.

E. CONTRACTOR procedures for hauling and disposal of Transite piping, and any other ACM wastes, shall comply with 40 CFR 61, Subpart M, and State, Regional, and Local standards.

3.07 COMBINATION OF WASTES

CONTRACTOR shall not combine materials from other projects with materials from the Site, unless otherwise approved by ENGINNER in advance. It is acceptable to combine drummed materials from the Pechiney Site with other project Site drummed materials if the hauling vehicle is transporting a less than full load of drummed materials from the Pechiney Site to the same receiving facility and the drummed contents are maintained separately.

3.08 QUANTITY RECORDS

CONTRACTOR shall create and maintain a Disposal Log as previously described in Part 1.02.

TRUCK ROUTES AND STAGING AREAS

A. CONTRACTOR shall utilize only truck Site access routes as shown on the Drawings. Vehicles shall not travel on other alternate routes without prior authorization from the City of Vernon. CONTRACTOR shall follow designated routes specified in the Hazardous Materials Transportation Plan, AMEC Geomatrix, Inc., 2010 for all PCB-impacted soil and concrete wastes transported off-Site. B. CONTRACTOR shall schedule and stagger all trucks and material deliveries to minimize on-Site and off-Site congestion and to prevent accidents. CONTRACTOR shall stage all off-Site transportation vehicles in their designated Truck Staging Areas.

C CONTRACTOR'S transportation vehicles shall not be present on public roadways at the Site between the hours of 7:00 p.m. and 5:00 a.m. Direct-loading of trucks on active public roadways is strictly prohibited.

PART 4 – PAYMENT

Off-Site Transportation and Disposal includes all Work associated with disposal of the wastes generated from the Work. Work includes, but is not limited to, profiling, manifesting, encapsulation as necessary, loading, hauling truck cleaning and decontamination, transporting, and disposing of the waste generated as specified in Off-Site Transportation and Disposal. Work does not include waste generated by the CONTRACTOR or other wastes unless otherwise noted. Unit pricing shall include Federal, State and Local taxes where applicable.

Measurement will be based on units (Tons, Cubic Yards, Gallons) of materials shipped off-Site for disposal, as applicable, as determined by the receiving facility. Payment will be based on the respective unit prices provided in the Bid Form for each waste category as described below.

A. Payment for Off-Site Transportation and Disposal will be based on the Contract unit price listed under Bid Items 16.1 through 16.22 and will be full compensation for CONTRACTOR'S Work for Off-Site Transportation and Disposal.

Item 16.1 – PCB-Impacted Soil (Non-TSCA < 50 mg/kg) includes all soil generated that requires landfill disposal.

Item 16.2 – PCB-Impacted Soil (TSCA > 50 mg/kg but less than 1000 mg/kg) includes all soil generated that requires landfill disposal.

Item 16.3 – PCB-Impacted Soil (TSCA > 1000 mg/kg) includes all soil generated that requires landfill disposal.

Item 16.4 – VOC-Impacted Soil (Non-Hazardous) includes all soil generated that requires landfill disposal. VOCs known to exist at the Site and their respective Non-Hazardous thresholds include PCE < 14 mg/kg, TCE < 10 mg/kg, Vinyl Chloride < 4 mg/kg.

Item 16.5 – VOC-Impacted Soil (non-RCRA CA-Hazardous) includes all soil generated that requires landfill disposal. VOCs known to exist at the Site and their respective non-RCRA CA-Hazardous thresholds include PCE > 14 mg/kg, TCE > 10 mg/kg, Vinyl Chloride > 4 mg/kg.

Item 16.6 - Metals-Impacted Soil (Non-Hazardous) includes all soil generated that requires landfill disposal. Known metals to exist at the Site and their respective Non-Hazardous thresholds include Arsenic < 50 mg/kg, Lead < 50 mg/kg, Chromium < 50 mg/kg, Copper < 250 mg/kg, Zinc < 2,500 mg/kg. CONTRACTOR shall provide unit cost for disposal of waste containing PCBs, but is characterized as non-TSCA waste.

Item 16.7 – Metals-Impacted Soil (non-RCRA CA-Hazardous) includes all soil generated that requires landfill disposal. Known metals to exist at the Site and their respective non-RCRA Cal Hazardous thresholds include Arsenic > 50 mg/kg, Lead > 50 mg/kg, Chromium >50 mg/kg, Copper < 250 mg/kg, Zinc < 2,500 mg/kg.

Item 16.8 – Stoddard Solvent Impacted Soil (Non-Hazardous) includes all soil that requires landfill disposal.

Item 16.9 – TPH-Impacted Soil (Non-Hazardous) includes all soil that requires landfill disposal.

Item 16.10 – PCB-Impacted Water (Non-TSCA < 5 mg/L) includes all water generated, including recovered decontamination water,or encountered that requires disposal or additional treatment.

Item 16.11 – PCB –Impacted Water (TSCA > 5 mg/L) includes all water generated, including recovered decontamination water,or encountered that requires disposal or additional treatment.

Item 16.12 – VOC-Impacted Water (Non-Hazardous) includes all water generated or encountered that requires disposal or treatment. VOCs known to exist at the Site and their respective Non-Hazardous thresholds include PCE < 0.7 mg/l, TCE < 0.5 mg/l, Vinyl Chloride < 0.2 mg/l.

Item 16.13 – VOC-Impacted Water (Hazardous) includes all water generated or encountered that requires disposal or treatment. VOCs known to exist at the Site and their respective Hazardous thresholds include PCE > 0.7 mg/l, TCE > 0.5 mg/l, Vinyl Chloride > 0.2 mg/l.

Item 16.14 – Metals-Impacted Water (Non-Hazardous) includes all water generated or encountered that requires disposal or treatment. Known metals to exist at the Site and their respective Non-Hazardous thresholds include Arsenic < 5 mg/l, Lead < 5 mg/l, Chromium < 5 mg/l, Copper < 25 mg/l, Zinc < 250 mg/l.

Item 16.15 – Metals-Impacted Water (Hazardous) includes all water generated or encountered that requires disposal or treatment. Known metals to exist at the Site and their respective Hazardous thresholds include Arsenic > 5 mg/l, Lead >5 mg/l, Chromium >5 mg/l, Copper >25 mg/l, Zinc >250 mg/l.

Item 16.16 – Asphalt Debris Off-Site Recycle includes all asphalt removed during demolition of roadways, slabs and pavements, excluding asphalt containing PCBs >3.5 mg/kg for off-Site recycling, or disposal as solid waste.

Item 16.17 – PCB-Impacted Concrete or Asphalt debris (TSCA bulk PCB Remediation Waste, PCBs >3.5 mg/kg but < 50 mg/kg) includes all PCB-impacted concrete slabs, pavements, foundations, footings, pits and sumps removed requiring landfill disposal.

Item 16.18 – PCB-Impacted Concrete or asphalt debris (TSCA Hazardous Waste, PCBs > 50 mg/kg, but <1,000 mg/kg) includes all PCB-impacted concrete slabs, pavements, foundations, footings, pits and sumps removed requiring landfill disposal.

Item 16.19 – PCB-Impacted Concrete or asphalt debris (TSCA Hazardous Waste, PCBs >1,000 mg/kg) includes all PCB-impacted concrete slabs, pavements, foundations, footings, pits and sumps removed requiring landfill disposal.

Item 16.20 – Transite piping, ACM waste (Asbestos Containing Material). Off-Site Transportation and Disposal of Transite Piping or other ACM wastes.

Item 16.21 – Hydraulic Oil includes oil removed from deep hydraulic ram that requires disposal as a non-PCB-Containing liquid.

Item 16.22 – Hydraulic Oil removed from deep hydraulic ram that requires disposal as a PCB –Containing liquid (PCBs < 50 mg/l).

B. There shall be no separate payment for CONTRACTOR'S implementation and compliance with the other requirements of this Section.

END OF SECTION

SECTION 02260

EXCAVATION SUPPORT AND PROTECTION

PART 1 – GENERAL

1.01 SUMMARY

The Work under this Section includes furnishing all labor, materials, appliances, tools, equipment, transportation, services, and supervision required for designing, furnishing, installing, maintaining, and removing mechanical excavation support systems, and for the protection and restoration of adjacent structures, including repair of any settlement-related damage. The CONTRACTOR is responsible for all permits, notifications and inspections associated with Excavation Support and Protection.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to the Work of this Section.

B. Section 02351 – Backfilling and Grading.

1.03 APPLICABLE STANDARDS AND SPECIFICATIONS

A. Regulatory requirements which govern the Work of this Section include, but may not be limited to, the following governing codes:

1. California Code of Regulations, Title 8, Chapter 4, Subchapter 4 — Construction Safety Orders, and Subchapter 19 — Trench Construction Safety Orders.
2. California Code of Regulations, Title 24, Part 2, California Building Code, Chapter 33 and Appendix Chapter 33, and Structural Chapters 18 and 18A.
3. Excavations, regardless of depth, shall comply fully with the requirements of Sections 3301.2, 3301.2a, and 3301.3 of the California Building Code.

1.04 SUBMITTALS

A. The CONTRACTOR shall submit an Excavation Protection Plan, sealed and signed by a professional civil engineer currently registered with the State of California. The Excavation Protection Plan shall provide a detailed plan for supporting and/or sloping excavation sidewalls during the Work to prevent damage to existing buildings and utilities, support traffic on adjacent roadways, and to protect personnel that enter the excavation during the Work. The approximate depth to groundwater at the Site is 150 feet. In designing excavation protection, CONTRACTOR shall assume that excavations will extend 2 feet below the depths shown on the Drawings. All drawings, calculations, and test reports utilized to develop the Excavation Protection Plan shall be included with the submittal.

B. The Excavation Protection Plan shall be consistent with all applicable regulations including the Cal/OSHA Construction Safety Orders.

C. The Excavation and Protection Plan shall include the proposed method for penetration of utilities into the excavation.

D. Design excavation support systems to support earth pressures, utility loads, equipment, applicable traffic and construction loads, and other surcharge loads in a manner which will allow the safe and expeditious completion of the Work without movement or settlement of the ground and in a manner which will prevent settlement of and damage to, or movement of, adjacent buildings, structures, utilities, or other facilities during the various stages of construction. Include evaluation of the effects of flooding and dewatering of excavation.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND FACILITIES

A. The CONTRACTOR shall furnish all tools, equipment, devices, appurtenances, facilities, and services for the construction and removal of excavation support systems as indicated in the Excavation Protection Plan.

2.02 MATERIALS

A. General: Materials for excavation support systems may be new or used, provided they are sound and free from strength-impairing defects.

PART 3 – EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Install all excavation support systems required to ensure the safety and preservation of workers and to protect existing improvements. Excavation support systems shall be consistent with the Excavation Protection Plan.

3.02 INSPECTION OF EXCAVATION SLOPING OR MECHANICAL SUPPORT SYSTEMS

A. If the engineer or the licensed engineer whose name and stamp appear on the Excavation Protection Plan determines that excavation sloping constructed by the CONTRACTOR does not comply with the Excavation Protection Plan, the CONTRACTOR shall improve the excavation sloping at no extra cost to the OWNER.

B. Prior to excavating soil within 50 feet of a mechanical support system, the licensed engineer whose name and stamp appears on the Excavation Shoring and Support Plan shall confirm in writing that the mechanical support system has been installed in accordance with the Excavation Protection Plan.

C. If the engineer or the licensed engineer whose name and stamp appear on the Excavation Protection Plan determines that an existing support system installed by the CONTRACTOR does not comply with the Excavation Protection Plan, the CONTRACTOR shall remediate or reinstall the support system at no extra cost to the OWNER prior to excavating soil within 50 feet of the mechanical shoring systems.

3.03 REMOVAL OF EXCAVATION SUPPORT SYSTEMS

A. If removal is required wholly or in part, CONTRACTOR shall perform such removal in a manner that will not disturb or damage adjacent buildings, structures, construction, or utilities. CONTRACTOR shall fill voids immediately with CLSM or with approved backfill compacted to the relative compaction for the location as specified in Section 02351 – Backfilling and Grading.

3.04 RESTORATION

A. CONTRACTOR shall restore, at its own expense, existing structures damaged by its excavation activities to conditions equivalent to those prior to the start of Work. This shall include repairing all settlement-related damage.

PART 4 – PAYMENT

A. Measurement of installation, maintenance, and removal of mechanical shoring or bracing to support excavation of Below Grade Demolition and Soil Excavation Work as shown on the Drawings will be based on square feet of Excavation Support and Protection in a vertical plane. Payment for Excavation Support and Protection will be based on the unit price provided in the Bid Form and will be full compensation for all CONTRACTOR Work for Excavation Support.

END OF SECTION

SECTION 02351

BACKFILLING AND GRADING

PART 1 – GENERAL

1.01 SCOPE

A. This Section covers the requirements for the import, placement, and testing of fill materials in excavations performed as a part of the Work. This Section also covers placement and grading of fill materials to accommodate the final elevations shown on the Drawings.

B. CONTRACTOR shall supply all materials, equipment, and services required for grading, excavating, loading, hauling, backfilling, and compacting operations.

C. All excavations and any test trenches performed as a part of the Work shall be backfilled by CONTRACTOR.

D. The backfill material used to meet the final elevations shown on the Drawings shall consist of recycled aggregates generated on-Site from crushing or pulverizing of concrete demolition debris. Other backfill materials required for selective backfilling of deeper structures shall be brought to the Site from off-Site sources or recovered from previously backfilled structures on-Site as needed.

E. The Work under this Section shall include all Work by CONTRACTOR required to load, haul, place, compact and grade backfill material required from on-Site or from off-Site sources, as approved by ENGINEER.

F. Excavating, pulverizing, filling, backfilling, compacting and grading by the CONTRACTOR during construction shall be performed in a manner and sequence that will minimize multiple handling of soil and fill material.

G. CONTRACTOR shall maintain all Work areas free from excess dust as specified in Section 01501- Dust Control and avoid causing a hazard or nuisance to others. Dust control shall be performed as the Work proceeds and wherever a dust nuisance or hazard occurs.

1.02 RELATED REQUIREMENTS

A. Section 01501 – Dust Control

B. Section 01510 – Mobilization and Demobilization

C. Section 02050 – Demolition

1.03 RELATED DOCUMENTS AND SPECIFICATIONS

A. "GREENBOOK" – Standard Specifications for Public Works Construction (2006 Edition).

1.04 SUBMITTALS

A. CONTRACTOR shall supply to the ENGINEER two cubic feet of material representative of each import backfill material for geotechnical laboratory analysis at least 10 calendar days prior to use at the Site.

B. CONTRACTOR shall designate a single source for each import backfill material and provide a recent material analysis for each specified material demonstrating conformance with the Specifications. Provide access for ENGINEER to collect samples for chemical analysis for the analytes listed in Part 1.04(D) at least 21 calendar days prior to use at the Site. Anticipate 14 calendar days between ENGINEER'S sampling and receiving testing results. CONTRACTOR shall not deliver any material to the Site until it has been favorably reviewed by ENGINEER.

1.05 QUALITY ASSURANCE

A. CONTRACTOR shall ensure that the material and workmanship provided are in accordance with the specified requirements.

B. ENGINEER will inspect placement and compaction of fill.

C. As directed by ENGINEER, CONTRACTOR shall excavate holes for in-place soil sampling and/or density testing of fill by ENGINEER. CONTRACTOR shall be responsible for all costs for additional inspection and testing resulting from non-compliance with compaction requirements. ENGINEER may perform compaction testing on any lift of backfill material at any time at ENGINEER'S discretion.

D. Testing Methods:

1. Geotechnical Methods:

   Maximum dry density and optimum moisture content of earthen materials shall be determined according to ASTM D1557. In situ density and moisture content shall be determined with a nuclear density meter according to ASTM D2922.

2. Environmental Analytical Methods for Imported Backfill:
   Title 22 Metals , EPA Method 6010 and 7471A
   Pesticides/Herbicides, EPA Method 8081A, 8141A, 8151A
   Semi-volatiles, EPA Method 8270C
   Volatile Organic Compounds, EPA Method 8260B
   TPHg, TPHd, and TPHmo, EPA Method 8015modified/EPA Method 3630A

PART 2 – PRODUCTS

2.01 BACKFILL MATERIALS

A. Greenbook 200-2.4 Aggregate: CONTRACTOR shall crush concrete for use as unrestricted fill material. Crushed recycled aggregate materials generated from on-Site crushing of concrete demolition debris shall be utilized to backfill foundation and structures removal excavations and hot spot soil removal areas as shown on the Drawings. Crushed recycled Aggregate shall conform to the grading and quality requirements shown in the following tables from Greenbook 200-2.4 specifications. At the option of the CONTRACTOR, the grading for either the 1 1/2-inch maximum or 3/4-inch maximum shall be used, except that once a grading is selected the grading shall not be changed without the ENGINEER'S written approval.

GRADING REQUIREMENTS

	Percentage Passing			
	1½" Maximum		¾" Maximum	
Sieve Sizes	Operating Range	Contract Compliance	Operating Range	Contract Compliance
2"	100	100	—	—
1½"	90-100	87-100	—	—
1"	—	—	100	100
¾"	50-85	45-90	90-100	87-100
No. 4	25-45	20-50	35-60	30-65
No. 30	10-25	6-29	10-30	5-35
No. 200	2-9	0-12	2-9	0-12

QUALITY REQUIREMENTS

Test	Operating Range	Contract Compliance
Resistance (R-value)	—	78 Min.
Sand Equivalent	25 Min.	22 Min.
Durability Index	—	35 Min.

B. Pea Gravel: Typical requirements for Pea Gravel conform with "GREENBOOK - Standard Specifications for Public Works Construction (GREENBOOK)" and are outlined below.

GRADING REQUIREMENTS

Sieve Sizes	Percentage Passing GREENBOOK No. 4
19.0 mm (3/4")	100
12.5 mm (1/2")	-
9.50 mm (3/8")	85-100
4.75 mm (#4)	0-30
2.36 mm (#8)	0-10
1.18 mm (#16)	-
75 um (No. 200)	0-2

C. Portland Cement Concrete shall be concrete class 560-C-3250 per the GREENBOOK specifications Section 201.

D. CLSM shall have a consistency that will result in a flowable product at the time of placement which does not require manual means to move it into place. CLSM ingredients shall include, water, Portland Cement, fine aggregate, and any admixtures that complies with all ASTM and Greenbook standards and specifications. Maximum aggregate size shall be 3/8 in.

E. Existing Site Backfill: CONTRACTOR at their discretion shall reuse Site backfill materials that originated from the demolition of Previously Backfilled and Decommissioned Structures, only if the material is granular and free of COPCs, with ENGINEER'S prior approval.

F. Imported Structural Fill: Only with approval of ENGINEER shall CONTRACTOR import clean structural fill for use in Backfilling and Grading Work. Imported Structural Fill shall meet the general specification outlined below.

Sieve Sizes	Operating Range	Contract Compliance
2"	100	100
1½"	90-100	87-100
1"	—	—
¾"		
No. 4	25-45	20-50
No. 30		
No. 200	0-12	0-15

Liquid Limit of less than 35;
Plasticity Index and Expansion Index of less than 30; and
Free of any detrimental quantity of deleterious material.

G. Pulverized Concrete shall be sized for use as a Restricted Use Fill and treated as an open graded aggregate. Typical particle size after pulverizing shall range between 3 and 5 in. ENGINEER will inspect gradations of pulverizing periodically to ensure this particle size range is met by CONTRACTOR.

PART 3 – EXECUTION

3.01 PROTECTION OF EXISTING FACILITIES

A. CONTRACTOR shall be responsible for protection of existing structures, sidewalks, pavements, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations on neighboring properties or within the property, shown on the Drawings to be protected.

3.02 PLACEMENT AND COMPACTION

A. CONTRACTOR shall place and compact backfill in excavations promptly, but not before completing the following:

1. Surveying locations of remaining underground utilities or structures for Project Record Documents.
2. Inspecting underground utilities.
3. Removing trash and debris.
4. Removing any ponded water.
5. Removing temporary shoring and bracing, and sheeting.
6. Receiving approval from ENGINEER that any required soil confirmation sampling, as specified in Section 02110, has been completed.

B. CONTRACTOR shall place material in continuous maximum 12-inch thick lifts to meet final elevations within a tolerance of plus or minus 0.1 foot. CONTRACTOR shall plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. All fill shall be compacted at a moisture content no more than 3 percent above optimum or 1 percent below optimum and shall meet the following minimum percentages of maximum dry density as determined by ASTM D1557 (Modified Proctor Test):

Crushed Aggregate Base	90%
Native Soil	90%
Imported Structural Fill	90%
Pea Gravel	Mechanically Vibrated

Pulverized Concrete Mechanically Vibrated

D. No compacting shall be done by CONTRACTOR when the material is more than 3 percent greater than the optimum moisture content either from rain, groundwater, or excess application of water. At such times, Work at the area where moisture conditions are unsatisfactory shall be suspended by CONTRACTOR until the previously placed and new materials have dried sufficiently to permit proper compaction. In order to expedite backfilling of critical areas to prevent washouts by storm water or other inconvenience, CONTRACTOR may scarify wet soils to speed the air-drying process.

E. No compacting shall be done by CONTRACTOR when the material is more than 1 percent less than the optimum. At such times, CONTRACTOR shall apply water to previously placed material and new material until the material is moistened sufficiently to permit proper compaction.

F. CLSM shall be utilized as backfill material below underground utilities or inside utilities or pipelines to be grouted in place, as shown on the Drawings, as follows:

1. CLSM shall be placed using a concrete pump and tremie pipe such that CLSM does not fall more than 24-inches from outlet of the tremie pipe to the top of the prepared surface.

2 If the excavation to be filled contains standing water, the tremie pipe shall be lowered to the bottom of the excavation to be filled and CLSM pumped through the pipe. As filling continues, the bottom of the tremie pipe shall not be raised above the level of the top of the CLSM until the specified final grade is achieved.

3.03 GRADING

A. CONTRACTOR shall perform pre-construction survey to determine if excavation and backfill quantity estimates as shown on the Drawings allow CONTRACTOR to achieve estimated rough grading final elevations.

B. CONTRACTOR shall uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated as specified in this section.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerance.

C. Final elevations shall be within 0.1 foot of the elevations as shown on the Drawings.

D. In the event that excavation areas are less than or greater than expected and backfill quantities are increased or reduced as a consequence of changes in excavation volume, CONTRACTOR shall adjust grades and elevations after consultation with ENGINEER, to meet the general intention of relative grades and flow lines as shown on the Drawings, all to the satisfaction of the ENGINEER.

3.04 TESTING

CONTRACTOR shall perform soil testing, as required, to ensure proper execution of the Work and to verify material quality and to determine compaction characteristics, moisture content, and density of fill and backfill in place. These tests performed by CONTRACTOR will be used to verify that the fill and backfill conforms to the requirements of this Section. ENGINEER may conduct confirmation testing.

PART 4 – PAYMENT

A. Backfilling and Grading of Crushed Recycled Aggregates for use as unrestricted fill, including Placement and Compaction, will not be measured separately. It is considered incidental to Crushing as covered under Bid Form Item 11.1 and described in Section 2050 – Demolition. There shall be no separate payment for CONTRACTOR or Subcontractor incidentals pursuant to implementation and compliance with the requirements of this Section and shall include full compensation for all CONTRACTOR implementation and compliance for Backfilling and Grading of Crushed Recycled Aggregates.

B. Backfilling of Pea Gravel or Existing Site Backfill into former structures greater than 10 - feet Below Grade will not be measured separately. It is considered incidental to Demolition of Subsurface Structures Greater than 10 - feet Below Grade as covered under the appropriate Bid Form Items and described in Section 2050 – Demolition. There shall be no separate payment for CONTRACTOR or Subcontractor incidentals pursuant to implementation and compliance with the requirements of this Section and shall include full compensation for all CONTRACTOR implementation and compliance for Backfilling of Pea Gravel.

C. Backfilling of Imported Structural Fill, including Placement and Compaction, shall include all materials, equipment, and labor as required for Backfilling as described in the Specifications. Payment for Backfilling of Imported Structural Fill will be made at the Contract unit price (per Ton) as stated in the Bid Form and shall include full compensation for all CONTRACTOR implementation and compliance for Backfilling of Imported Structural Fill.

D. Grading will be measured as a unit and shall include all materials, equipment, and labor as required for Grading as described in the Specifications. Payment for Grading will be made at the Contract unit price (per Acre) as stated in the Bid Form and shall include full compensation for all CONTRACTOR implementation and compliance for Grading.

E. Backfilling and Grading of Pulverized Concrete for use as restricted fill, including Placement and Compaction will not be measured separately. It is considered incidental to Concrete Pulverizing as covered under Bid Form Item 11.2 and described in Section 2050 – Demolition. There shall be no separate payment for CONTRACTOR or Subcontractor incidentals pursuant to implementation and compliance with the requirements of this Section and shall include full compensation for all CONTRACTOR implementation and compliance for Backfilling and Grading of Pulverized Concrete.

F. There shall be no separate payment for CONTRACTOR'S implementation and compliance with the other requirements of this Section.

END OF SECTION